THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIII. No. 1359.] LONDON, MAY 28, 1889. [41ST YEAR. Price 6d.

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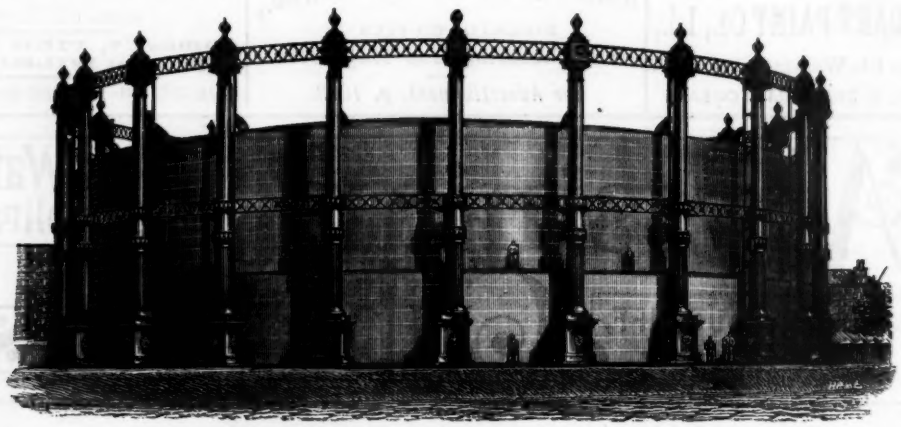

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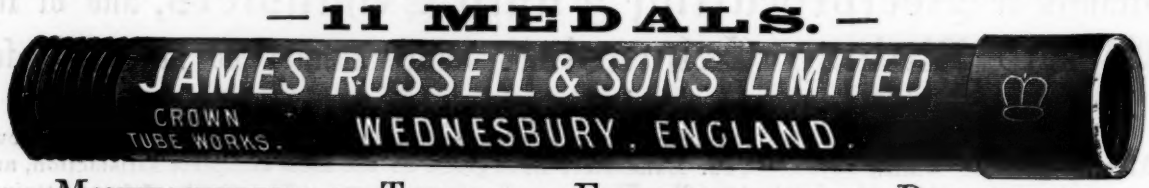

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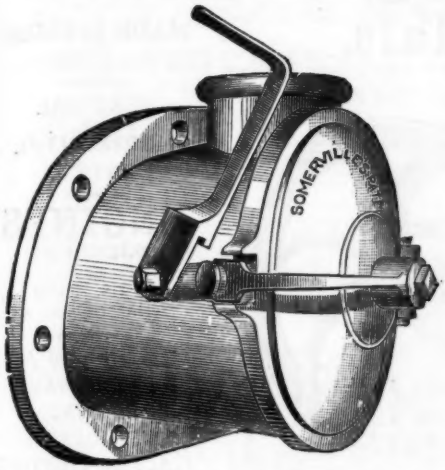

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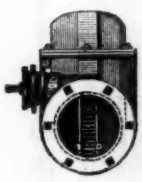

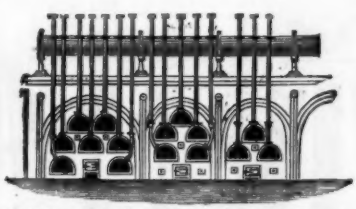

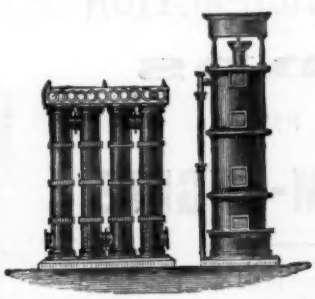

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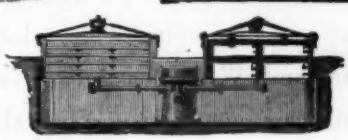

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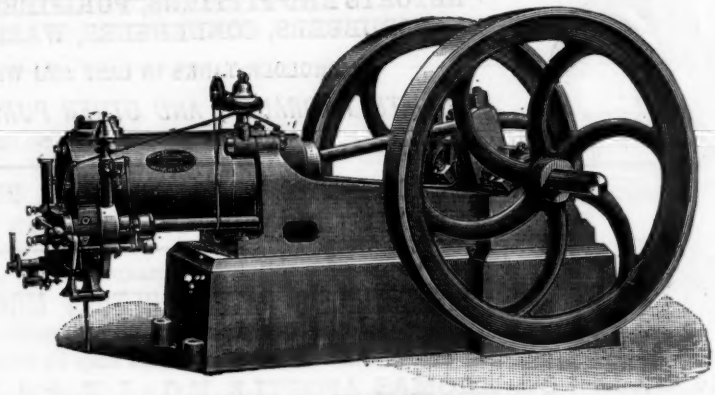

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1. The weight in motion is **only one-seventh** of that in the present machine.
2. It requires only **one-seventh** the power to drive; consequently effecting a large reduction in cost of Engine as well as in steam power.
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5. It is so constructed that it forms a most powerful, effective, and complete system of purification, gives no pressure, and can be removed and replaced without trouble or injury.
6. The "New Standard," owing to the foregoing, can be supplied at **a large reduction in price.**

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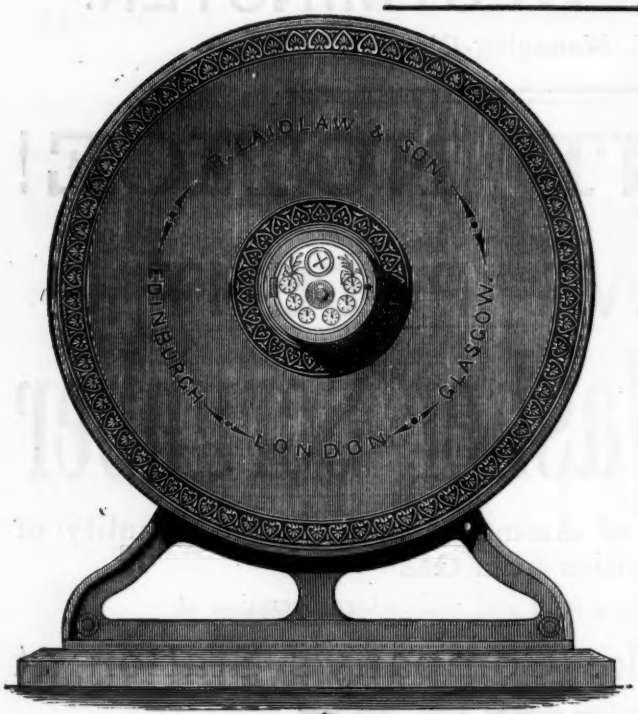
IN ROUND OR SQUARE CASES, ALL SIZES.



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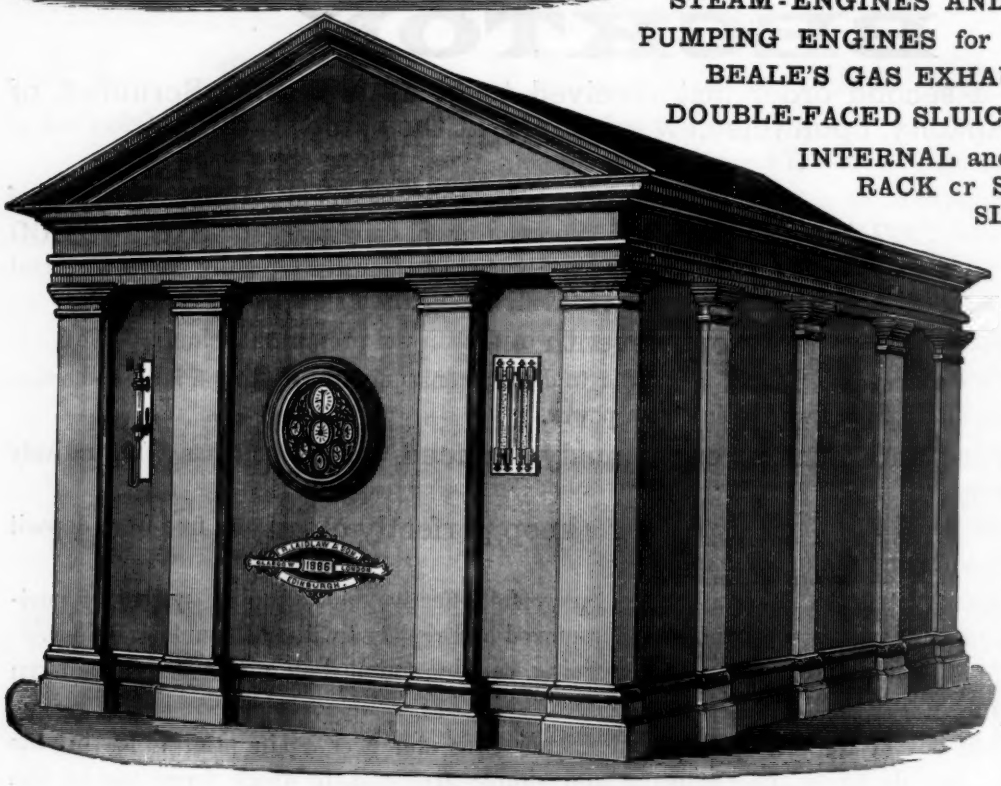

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AND FOR USE IN

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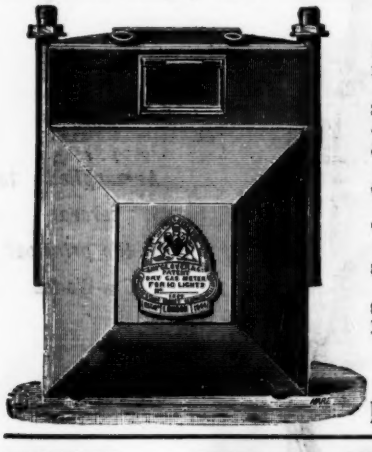

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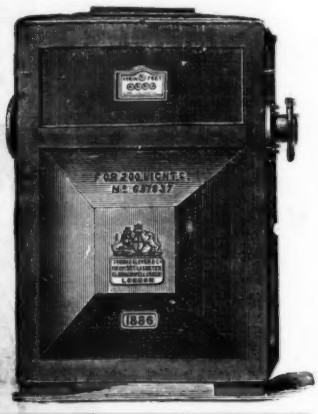

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 28, 1889.

THE DEBATE ON THE PROPOSED ABOLITION OF THE LONDON COAL DUES.

THE subject of the Coal Dues of the City of London was well debated in the House of Commons last Wednesday, on the Bill of Sir Joseph Pease to abolish all duties of the kind as affecting the Metropolitan area. It may appear strange at the first glance that such a debate should have arisen, seeing that it is understood that the dues at present paid under an Act of Parliament which expires in July are not to be renewed. The reason, however, is soon found. The existing statutory dues are compounded of imposts of different origin, and levied at different periods, whereof one—a duty of 4d. per ton—is claimed by the Corporation of the City of London as theirs by right of Charter and immemorial usage. The City authorities have always had a portion of the present dues allocated to them; and now they threaten that, whether Parliament allows the consolidated duty to lapse or not, they mean to have their own proper due of 4d. per ton. They have gone so far as to assert that Parliament has no power to interfere with such a prescriptive right; but this must have been a Corporation joke, intended to cover the plea that specific legislation, accompanied with recognition of the right to compensation, should be required to deal with a privilege of this character. The Government have so far recognized the right of the City in this matter that they have allowed Sir Joseph Pease's Bill to be read a second time, with the proviso that it is to be considered by a Hybrid Committee. Meanwhile the debate was the occasion of a very complete statement of the arguments for and against the principle of the dues; and it was sufficiently shown that the sense of the House was against all such indirect ways of raising revenue for Municipal purposes. A full abstract of the debate will be found in another column. As was only natural, the orators on behalf of the Corporation thought they had a strong argument in stigmatizing the Bill as a production of the coal-mining interest; but they forget that the imputation of interest cuts both ways. The question of the bearing of the Coal Dues upon the Metropolitan gas supply was again brought forward, and Mr. George Livesey's engagement to give the consumers all the benefit of the reduction in the price of gas, due to the removal of the dues, was once more mentioned with good effect. The worst that we fear in connection with this aspect of the matter is that the recent advance in the value of gas coals and in freights may appear to neutralize the benefit that would otherwise arise from the removal of the dues, and may be accordingly cited by the City people as evidence of the soundness of their contention that the abolition of the tax would not make any real difference to the consumer of coal or gas. The City authorities are quite capable of anything of this sort—indeed, such a slight misrepresentation would be nothing to the men who a year or two since engaged in the scandalous manufacture of spurious public opinion for the sake of bolstering up the expiring dues. Wednesday's vote was sufficiently conclusive, however, to show even Gog and Magog that the game is up; and we do not look for another serious discussion of the subject when the Committee present their report, which will almost certainly be in favour of taking away the right to tax coal without any other compensation beyond what may be held to reside in the power to make a commensurate rate.

GAS-MAINS IN ROADS.

THE paper by Mr. W. T. Tew, of Warwick, upon unaccounted-for gas, presented to the Midland Association of Gas Managers at their last meeting (see *ante*, p. 950), although it only raises one point in connection with the subject, yet serves to draw attention to the matter once more. The question is one in which sanitarians like Major-General Webber—whose remarks upon it were not the least important of the contents of his Hastings address recently reproduced in our columns—take an intelligent interest. What they think about, however, is the single question of leakage from gas-mains into the soil; they naturally do not care for the other points that go to make up the inevitable difference between the bulk of gas made and sold or otherwise accounted for, which is such an important thing for gas managers. The first crude idea of the ordinary sanitary reformer is that all the gas which cannot be traced necessarily escapes from the mains; and he has to be argued with respecting those effects of difference of temperature of which Mr. Tew speaks, and informed of the influence of the permissible error of consumers' meters, which, on the whole, is against the company. Still, after taking account of the effects of temperature, errors of measurement, condensation, barometrical variation, errors of street-lamp governors, waste in making connections, and any other minor matters that may be brought into the question, the fact remains that a good deal of gas does leak out of the mains of a gas-distributing system—the greater part of it insensibly. Sanitarians also charge upon gas engineers that the method of expressing the leakage in terms of the total make, although sound enough for commercial purposes, is misleading as to the fact; and that, for engineering reasons, it ought to be calculated upon the unit of length or capacity of the mains from which it escapes.

There is something in the argument, although it would be a practical impossibility to carry out such a calculation with any satisfactory degree of reliability. Sanitarians would admit that gas leakage from mains and services has been sensibly reduced of late years, particularly with regard to the laying of services. At the same time, it is impossible for anyone to pass along a road where gas-mains are being relaid without acknowledging that it would be a good thing if some of the leakage that has poisoned the subsoil for yards on both sides of the pipe could be prevented. The question is, how? and it is difficult to find an answer. It may be supposed that this effect of gas-mains upon the subsoil of roads has been studied by many gas managers; but we do not at present recall any statement or paper on the subject as distinguished from the general questions of pipes and joints. That cast iron, of the substance ordinarily employed for underground gas-mains, is permeable by coal gas, is tolerably certain, always providing that sufficient time is allowed. That, where the soil is clayey, the escaped gaseous mixture forms appallingly nasty and complex compounds with the aluminous bases of the earth, does not need demonstration. The nuisance ought to be susceptible of cure. Bitumenizing the pipes will not serve; but we recall an experience that may awaken a chord in the memory of some of our readers. A long time ago, when cast-iron ordnance were used by Government, a large foundry had a contract for a number of 68-pounders which were to be cast of the best metal that could be bought for money. To make sure of the soundness of these guns, they were tested with water under hydraulic pressure, when, to the amazement and disgust of the founders, the moisture came through the thickness of the metal, and gathered in drops on the outside of the huge barrels. All were in danger of rejection on this account, when a happy thought occurred to the works manager. He determined to try whether water could not cure what it had shown to exist. Accordingly, he dissolved sal-ammoniac in water, and pumped it into the guns under pressure until the dew turned to rust outside. This was effectual. The pores of the metal rusted up, and thereafter the guns were as tight as a bottle to any hydraulic test. It is at least open to be asked whether some similar treatment would not make mains gas-tight. As to the joints, this is a different matter. We have no information to show the comparative foulness of the surrounding soil in the case of mains with different joints. Perhaps this may be forthcoming. The subject is worthy of attention, not only for the sake of sanitation, but also from the commercial standpoint. Of course, we do not grant that there is any particular danger to the health of the community from the presence of leaky gas-pipes in roadways; but everybody will admit that mains are apt to become unpleasant as they grow old, and this should be cured if possible.

EIGHT-HOUR SHIFTS IN GAS-WORKS.

The present talk about London gas stokers' shifts is having the good effect of bringing out some information respecting the general question which would not otherwise have been made public. It now appears that the eight-hour system is in vogue in a number of gas-works in different parts of the country, and is well spoken of by several engineers. It cannot be called a new idea, because it has been in existence for many years. The question is whether it is a better plan than the more general twelve-hour shifts. If it is, it is somewhat remarkable that it has not become more popular. We trust that the present opportunity will be taken of thoroughly discussing the matter, with a view to finding out what is best for employers and employed. It is certain that in the vast majority of cases gas managers wish to treat their men well, and are quite willing to adopt any system of working which will create the best relations between the manager's office and the retort-house. At this time of day nobody wants to quarrel over systems. Men are to be first consulted; and if any system can be shown to be unsatisfactory, so much the worse for it. The age has gone a long way in the direction of ameliorating the lot of labour; and it will go very much farther. All the same, it is advisable to argue the matter fully out before making a change, and then to start afresh, if found desirable, with the hearty agreement of both sides, instead of beginning it in strife and carrying it on in rancour. The gas stokers of London are a numerous army, it is true; but the Companies are not wholly at the mercy of any combination they may form, nor are the managers compelled to obey the behests of any demagogue whom the men may hoist into notoriety upon their shoulders. The best of good will prevails on both sides at present; and only the grossest mismanagement will spoil this pleasant state of things. Candidly, we do not yet admit that a triple shift in the day is preferable to the double one, for the reasons we have already expressed. The fact that an eight-hour shift works well in a town where it has been the custom for a good many years goes for no more than the similar fact that twelve-hour shifts work well in a number of other places. With an eight-hour shift, the men have less rest while on duty, which is a consideration not to be overlooked. It is to be hoped that when this question is settled, it will not be by an appeal to force on either side, that cannot be justified by sound reason. If it can be shown that an eight-hour shift is better than any other, by all means let it be the rule. If both parties to the discussion continue amenable to reason, there is no cause for thinking that the question cannot be settled without resorting to a strike or a lock-out. If, however, there should be any recourse to demagogy on the one side, and a too rigid upholding of the established system on the other, the outlook would speedily become unpleasant.

HOW FUEL GAS SHOULD BE MADE.

The amount of attention that is now being devoted to fuel-gas manufacture is perhaps the most satisfactory outcome of the water-gas "boom;" for it is just possible that some permanent improvement in the methods of production and utilization of cheap gas may result from the study that the general question is receiving in all parts of the world. Engineers are always working at water-gas problems in the United States; but now even Frenchmen, who have been forbidden by law to touch it, are discussing the same subject. There is one part of the question, however, which is of special interest for English engineers. It has been repeatedly shown that, as the raw material for the ordinary descriptions of fuel-gas plant, a non-caking coal or coke is required; but this condition is a serious drawback to the spread of the system, for certainly the greater portion of the cheap coals of the world are bituminous, and consequently caking. So far as can be ascertained from the conflicting reports on the subject, there does not appear to be any really successful process at present known for gasifying the worst and smallest bituminous coal refuse which is not worth carrying to a gas-works and carbonizing in the ordinary way. Gas is made occasionally out of such material, but never as a matter of choice. It is impossible to regard the fuel-gas question as settled in the engineering sense until somebody shall have brought out a universally applicable process for converting into gas both the bitumen and solid carbon of the most inferior kinds of slack that cumber the ground around coal-pits. This is the proper material for fuel gas. It is only half solving the problem to make gas of coal that can be used otherwise for any purpose, Such a process simply competes for raw material with other methods of consumption, and must therefore necessarily enhance its market value. Fuel gas will receive a fresh impetus if it can be made from material that is useless for any other purpose. It should not be beyond the power of science to extract the useful gases from slack, which only differs in its physical condition from the best coal. It can be gasified in the retorts of a coal-gas works; but it is so dirty, wet, and sluggish under the action of heat, when lying compacted in a closed vessel exteriorly fired, that it is more economical to buy a cleaner material for making gas which has to be sold in a purified condition. It is an essential feature of fuel gas that it is not to be purified by chemical process. The mere fact of its being gaseous is sufficient purity for the purposes to which it is applied. Slack will not pay for handling as coal is handled for making illuminating gas. Neither is it good enough to permit of the waste that goes on in a water-gas cupola during the process of "blowing up," or rendering the fuel incandescent by the air-blast. What is wanted is some such process as the following:—The slack, however wet, dirty, dusty, sulphurous, or stony, should be tipped into the hoppers of the gas-making cupolas, and gasification should go on continuously and completely, so that nothing but gas and ashes should remain of the material put into the apparatus. There is no inherent impossibility in this scheme of operation; but it has never been carried out successfully for any length of time. Mr. George Westinghouse is understood to have been working at some such problem in Pittsburgh for the past year or two; but he is apparently no nearer a complete solution than he was when he began, notwithstanding the amount of money

and the undeniable ingenuity he has lavished upon the work. Coal can be carbonized in closed retorts, and the resultant coke can be gasified in a blast of air or a current of steam; but the point that seems to baffle endeavour is to do the whole at once without waste, and to obtain the result in a condensed kind of gaseous fuel. The Siemens generators deal in a way with bituminous slack; but the product is very bulky, and only suited for immediate burning on the spot. If coal could be gasified in the way we have indicated, without an unwieldy admixture of the incombustible gases nitrogen and carbonic acid, it could be distributed to a distance, and the question of enlarging its range of portability by mechanical compression would be merely dependent upon determinable conditions. This is, therefore, the real problem of fuel gas for the future; and it is not touched by anything that has yet been done by the later race of projectors. When these work for choice with soft coal slack, and turn out nothing but gas and ashes, the prospects of fuel gas in all parts of the world will be better than they are at present. It is, in one sense, a waste of good material to turn anthracite and coke into gas, losing all the heat attending the conversion, and blowing a considerable percentage into the air as well. The complete continuous gasification of soft slack in a closed vessel is the only proper object for designers of fuel-gas processes.

GAS LIGHTING IN PARIS.

As we mentioned the electric lighting of the Paris Exhibition and the Eiffel Tower in our last issue, it is only fair that some notice should also be taken of the extent to which gas is used for lighting and illuminations in the same show. As a matter of fact, the exhibition authorities and the exhibitors are very large customers of the Paris Gas Company, who expect to find the usual difference between their summer and winter output considerably reduced this year, in consequence of the demand made upon them for lighting the mass of buildings now occupying the Champ de Mars. It would perhaps be an exaggeration to say that as much gas will be used in connection with the exhibition as would have been required if there had not been any electric lighting on the scene, seeing that the great machinery hall, described as the largest single room in the world, is brilliantly lighted by clusters of arc lamps. At the same time, it would not be surprising if, when the Paris Gas Company make up their accounts for the year, they should find that their sales have been as much increased in consequence of this, as in the case of any previous International Exhibition. At any rate, the Company will benefit from the enterprise as much in their degree as any other Parisian concern devoted to the supply of necessaries to the visitors and traders whom the exhibition will be the means of attracting to Paris. With regard to the use of gas in illuminations, it certainly appears that the Parisians are by no means inclined to ignore its capabilities for this purpose. As we have remarked when treating of the use of gas for illuminations, it is impossible to find any light more suitable for the most striking form of decoration on the large scale, which consists in outlining the principal architectural proportions of handsome buildings by rows of gas-burners. So far as can be gathered from reports that have yet come to hand, the Exhibition authorities have wisely abandoned the old device of twinkling lines of unprotected small gas-jets, which are subject to the caprices of the wind, and have adopted the bolder arrangement of large flames protected by opal globes. These are much better for large effects than the smaller flames, which are indeed only suitable for street decorations intended to be viewed at short range. The lavish employment of opal gas-globes for outside decorations has long been a feature of Parisian taste in this matter; and how just the idea is from the decorative point of view only needs to be more commonly recognized in this country. Here, where gas is cheaper than anywhere else in the world, there is the most conspicuous parsimony in its use; for every excursionist who does not happen to be better instructed comes home with the idea that Continental gas is much superior to British, simply because he sees more of it abroad than he is accustomed to at home. This is a pity, and if the numerous town councillors and other municipal dignitaries who within the next few months will make the pilgrimage to Paris, come away with the knowledge that a great deal of the proverbial sparkle and brilliancy of Parisian existence after dark is due to the habit of rejoicing in abundance of light for the main thoroughfares, and brings with him the desire to dispel the gloom of many of our chief towns by copying this cheerful taste, it will not be the least valuable result of his trip.

Water and Sanitary Affairs.

The Bill introduced by Captain Penton, and designed to restrict the power of the Metropolitan Water Companies in cutting off the domestic supply, was printed last week, and was down for second reading last evening. It is blocked by Baron Dimsdale; though, so far as its provisions go, the Companies might allow the Bill to pass, were it not that the enactment could be used as a means of harassing the Companies in the exercise of a power which is absolutely necessary if the water is neither to be wasted nor taken without payment. Parliament has confirmed this power on three different occasions; the last being at the passing of the Metropolis Water Act, 1871. The requisite clause is contained in the Water-Works Clauses Act of 1863; and we find a similar authorization in the Metropolis Water Act of 1852. The Act of 1871 provides for sanitary considerations by requiring that in every case of cutting off or ceasing to supply because of misconduct on the part of the consumer, the Company shall, within twenty-four hours, give notice of the fact to the Nuisance Authority as defined by the Sanitary Act of 1866. The power possessed by the London Water Companies is general throughout the kingdom; and there can be no sufficient reason why London should be treated exceptionally. In fact, the Bill altogether is a superfluous attempt at legislation. It requires that, before cutting off the supply, the Company shall obtain an order from a Court of Summary Jurisdiction. Thus the Police Magistrate intervenes to deal with a question which may be safely left where it is. His authority is invoked by the Bill simply for the purpose of ensuring that, before cutting off the supply, the Company shall give due notice to the consumer, and that there shall be "just and reasonable cause" for their action. It may be reasonably assumed that the Company will have no desire to lose a customer, and that they must have strong reason for ceasing to supply before taking such a course. The intervention of the Police Magistrate will simply increase the expense of the proceedings; and the effect will be to throw a further burden on the consumer in the shape of costs. A curious step taken by Captain Penton has been to get the Bill referred to the Examiners of Petitions for Private Bills, in order to see whether the Bill is in compliance with the Standing Orders relative to such measures. Captain Penton is taking great care of his bantling; but if the House of Commons is as well informed as it ought to be concerning this matter, the Bill can have no real chance of passing.

The London County Council, having said some very big things about the water supply of the Metropolis, are about to settle down to a study of the question. The facts of the case are to be got at by ransacking "a large number of "reports of Commissions and Committees," and by overhauling "various other parliamentary papers, copies of "which are in the possession of the Council." The information is said to be "voluminous;" and evidently it is too much so for the comfort of Mr. James Beal's Committee. Hence it is proposed that "a short digest of that portion of the infor- "mation which will be most valuable to the Council should "be prepared;" and it is said that this "can be done by the "existing staff without incurring expense." We pity "the "existing staff," some portions of which must be finding existence not very enjoyable, if all we hear is true as to the excessive hours of work imposed on these luckless mortals, who must indeed sigh for the good old days of the Metropolitan Board of Works. For the sins of Messrs. Robertson and Goddard, a number of weary scribes have to toil far beyond the limits of "office hours," with no promise of extra pay, and with restrictions respecting meals to which no true member of a Trades Union could ever submit. But these men are not bricklayers and carpenters, and accordingly are not fit subjects for the sympathy of Mr. John Burns and other working-men advocates. A very happy suggestion was made by Mr. Lawson when Mr. Beal brought up the report of his Committee. Mr. Lawson declared it to be impossible for the officers to digest and analyze "whole "reams of statutes." Such work, he contended, should be "solely undertaken by the Committee," who could thus occupy "some of their superfluous time." Mr. Beal signified, in reply, that the Committee "were prepared to do "their own work." If so, why did the Committee propose that the digest should be prepared by "the existing staff"? We go on to observe that Mr. Beal's Committee are specially charged with the question of the water supply. But while the members of this Committee are going into blue-books, the Parliamentary Committee of the Council have already

prepared a Bill seeking power for the Council to introduce Bills relative to the water supply, and to expend money in the conduct of inquiries and negotiations on that subject. When the Council get these powers, they may proceed to exercise them, if they still have the heart to do so. In the meantime they have plenty of scope for their energies in other directions, in which perhaps they can be more usefully employed. What we may expect now at the hands of Mr. Beal's Committee is, that they will pursue a royal road to learning, and will pick out certain plums from the parliamentary documents, such as the report adopted by the Select Committee of 1880 at the instance of Sir William Harcourt, who sat as Chairman of that Committee. But while the Council are learning their lesson under the guidance of Mr. Beal, time is passing; and in the absence of statutory power repealing the disabling clause in the Local Government Act, the Council will not be in a position to give notice next November of a Bill to deal with the entire question. However, it seems that Mr. Beal's Committee wish for power to spend money, in the first instance, for an inquiry into "the whole question of the water supply of "London." After that, the great Bill is to be prepared which is to settle the fate of the Metropolitan Water Companies. Threatened men live long; and perhaps the Companies will exist as long as Mr. Beal. The Bill introduced by Mr. O. V. Morgan and others, to enable the County Council of London to introduce new supplies of water into the Metropolis, and to "acquire the rights of existing Water Companies," stands for second reading on the 19th prox., having already suffered several postponements.

Mr. D. B. Mackenzie, son of Mr. William Mackenzie, of Dunfermline, has been appointed Manager of the Christchurch, New Zealand, Gas-Works.

We find from the complete list of awards at the Melbourne Exhibition, which has now been published, that the award to Messrs. John Wright and Co., of Birmingham, was a Second, and not a First Order of Merit, as stated in the Journal a fortnight ago.

The return furnished by the Chemist and Superintending Gas Examiner (Mr. W. J. Dibdin, F.I.C., F.C.S.) to the London County Council, on the results of his testings of the gas supplied to the Metropolis during the week ending the 21st inst., shows that on two occasions the illuminating power was below the standard—in one case to the extent of 0·1, and in the other to the extent of 0·2 candle.

In the course of the proceedings in the House of Lords Committee on the Smoke Nuisance Abatement (Metropolis) Acts Amendment Bill last week, private dwelling-houses were exempted from the operation of the measure; and a clause which would have brought all furnaces and fireplaces in hotels, clubs, and refreshment-rooms under the operation of the Smoke Nuisance Acts of 1853 and 1856 was struck out.

The New York and Philadelphia divisions of the Welsbach Incandescent Gas-Light Company are, says the *American Gaslight Journal*, being wound up. Under the conditions of the stock subscription lists, shareholders are being paid back their investment, less the amounts expended for running expenses since the shares were paid for. In the Philadelphia instance, this drawback amounts to $1·53 per share; while the New York drawback figures at $2. Writing on the same subject, the Philadelphia correspondent of *Industries* says:—"Rather more than a year ago a local Company was formed to introduce the Welsbach gas-burner. Shares were sold at £6, with the understanding that if within a year the Company was not on a paying basis, the money would then be refunded less expenses, which should not exceed 10s. per share. A notice has just been published stating that the balance of each share (about £5 7s.) would be returned on application, as the concern did not pay. Many burners are now in use in this city, and burn less gas than the ordinary burner; but they also give off a great amount of heat."

The General Manager of the Anglo-Continental Guano Works (Mr. Hermann Voss) puts down at 76,750,000 frs. the value of the fertilizers employed in England in 1886-7; nitrate of soda figuring for 18,750,000 frs. In 1863-5 the value was 89,250,000 frs., although the consumption has greatly increased since then. This anomaly is explained by the fact that the price of fertilizers has diminished very much during the intervening period. The important lesson to be remembered from these figures is, that in 1863, when French agriculturists in France scarcely knew of artificial manures, they were employed to the value of almost 90,000,000 frs. in England; and further, that the total area of cultivated land in England is not one-half that in France—10,000,000 hectares in England, compared with 25,000,000 hectares in France. To the foregoing must be added the value of other materials currently consumed by agriculturists in England, amounting to 10,400,000 frs., in which sulphate of ammonia figures for 7,800,000 frs. Further adding oil-cake, representing 37,000,000 frs., we get a total of 124,150,000 frs., as the total value of the fertilizers used in this country.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1012.)

During the past week the Stock Markets have been more than ordinarily quiet. Some were at times almost deserted; and the extreme heat of the weather towards the end of the week seemed to leave no energy to speculate with. Prices, however, did not droop; the tendency for the most part being the other way. The leading gas stocks have been depressed. Gaslight "A" has dropped 6. It had been generally expected that when Major Marindin's electric report came out, it would—unless it were adverse in an improbable degree to the electricians—send the price down at first. But the report came out sooner than was expected, and arrested the upward move of the stock before it had attained its probable figure. The 10 per cent. preferences, and the 7 per cent. maximum, have also receded 3 each. Of the other two Metropolitan Companies, South Metropolitan has been quiet and steady. The "A" and the debenture stocks have been done at good prices. Commercial has not been touched. Among Suburbans and Provincials, Brentford old was active on Thursday, at good average figures; and Brighton and Hove had made the advance of 1 which it promised. Alliance and Dublin, however, has fallen back ½. Among Foreigners, Imperial Continental has been in bad odour, and drooped almost daily, though no great amount has changed hands. The total loss is 7. Buenos Ayres has gained 1½. It opened on Monday well on the rise, when the report and accounts for 1888 were in hand (showing that an excellent year's business would produce a bonus of 2 per cent. on to the ordinary 8 per cent. dividend); and it continued to improve—the last week being 17½. Monte Video gained ½. Chicago bonds have also made an advance. The Water Companies have been quiet, especially towards the end of the week. The tendency has generally been favourable (always excepting Southwark, which fell 1); and Chelsea is 2 higher.

The daily operations were: Gas was active on Monday. Gaslight "A" was depressed by the issue of the report referred to above, and fell 2½; but Brighton and Buenos Ayres rose 1 each. Water was quiet and unchanged. Tuesday's Gas business was mostly in Gaslight stocks, which were all weaker. "A" and "J" fell 1 each; and "C," "D," and "E," 2. Imperial Continental also began to recede; dropping 2. Water was more brisk, and prices were good in general; but Southwark ordinary fell 1. Wednesday's business in gas was distributed over many undertakings, which were generally firm. Buenos Ayres and Monte Video rose ½, but Gaslight "A" fell 2 more, to 255,257. Imperial Continental also lost 2. A little business was done in Water at good figures. Gaslight continued weak on Thursday; and the "H" fell 3. The quotation of "A" was opened out to 254-258; the last mark being 255. Imperial Continental receded 1 more. Water offered no feature. There was renewed activity in Gas on Friday. Gaslight "A" was at one time down to 254, but recovered a little afterwards. The 10 per cents., however, receded from 1 to 2. Alliance and Dublin was ¼ worse; but Chicago second bonds rose 2½. Water was not touched. On Saturday, Gas was pretty brisk. Gaslights were steady; but Imperial Continental dropped 2 more. Chicago first bonds rose 2. Nothing was done in Water; but the quotation of Chelsea was put up 2.

ELECTRIC LIGHTING MEMORANDA.

ALTERNATING TRANSFORMERS AND DIRECT ELECTRICAL SUPPLY—THE SATURATION OF DISTRICTS WITH ELECTRIC LIGHTING—THE PALAIS ROYAL EDISON STATION—WOODHOUSE AND RAWSON, LIMITED.

One very interesting point comes out clearly as a result of the recent Board of Trade inquiry—the essential difference between the alternating transformer and direct systems of electrical supply. It was mentioned in the course of the investigation, by Mr. Moulton, Q.C.; but it has been accentuated by Major Marindin's report. In the first place, it does not appear that any wide difference of price is expected to mark the two rival systems; neither is the quality of lighting likely to be so superior with either that an ordinary spectator would be able to tell at a glance to which class any particular example of lighting might be assigned. The difference consists in the fact that a direct-supply system must be strictly localized, while a transformer system may be worked under what may be described as a roving commission. This difference is a very notable one regarded from the commercial and administrative standpoints. It has been taken by Major Marindin as warranting concurrent statutory concessions to two independent undertakings for the same district. There is no more justification for two direct-supply companies in one district than there would be for two gas companies. The reason for allowing competition between an alternating-transformer and a direct-supply company in the same area is that one may act as a check upon the other. An alternating-transformer company may have their generating station at a considerable distance from the point of supply, and, indeed, if the district is of a straggling character, this is the only system by which it could be successfully served. If, on the contrary, a town presents distinct *nuclei* of important buildings for which electric lighting may be desired, it is possible to serve these centres by localized stations supplying by the direct three-wire system. Supposing that there are three such *nuclei* in a town, representing respectively the fashionable or residentiary, commercial and theatrical, and manufacturing or shipping centres, these may be served by three separate

direct-supply stations all belonging to one company. In the same town there may be a number of isolated buildings that would take electric light if it could be had; but because they do not happen to be included in one of the *nuclei*, they cannot obtain a direct supply. For it must be understood that the expenses of a supply system of this kind increase enormously with distance from the central station. If at the same time an alternating-transformer company have a charter for the same town, they can range over the whole area from an outlying station, picking up customers wherever they can be found, and by the potentiality of their intervention keeping the localized stations up to the mark. This condition should not hurt the central stations, which having their business lying just round their doors ought to be able to sell as cheap as a company coming from a distance. If they cannot do this, they have no right to be there.

The circumstance that the point of saturation of a town for electric light at about two to three times the price of gas is speedily reached, explains a familiar feature of the invasion of a district by an electric light company. As soon as the new light is available it is patronized by a prominent set of residents. Very often the public lighting is placed in the hands of the speculators, which gives them a good start. At the same time a few of the richer or more advertising of the tradesmen subscribe for lamps; and consequently at the first general meeting or two after the company have once got to work the chairman is enabled to tell a striking tale of progress. So many hundred lamps subscribed for within such a short time—why, at this rate, all the lighting of the town will be in their hands in a year or two! So it would be if the rate were kept up; but, to the dismay of the Board, the process of entering new subscribers very soon comes to an end. After the first two years there is only a dropping fire of applications for the light, which scarcely balances the contrary movement of those consumers who, having become tired of its vagaries, quietly give it up and go back to gas. This is not only the case of electric lighting companies in England, where they are limited to a very few pleasure towns, but also represents the condition of affairs in the United States.

An example of the strictly localized character which is essential to the financial success of the direct electrical supply system is afforded by the experience of the Edison Company of Paris in connection with their new Palais Royal station. For the lighting of the Palais, and other neighbouring buildings, it was found absolutely necessary to construct the station in an underground chamber excavated below one of the principal Courts. To avoid the eyesore of carrying coals, &c., into this cellar through the Palais, a subterranean corridor of considerable length was cut to a neighbouring street, in which also the chimney is built, the smoke being brought to it through a flue 78 feet long. Why the whole station could not have been built in the same back street does not clearly appear from the published accounts, although there must be some reason to explain what looks otherwise like a mere *tour de force*. From the station the wires pass through the sewers wherever possible, and in the absence of these, through iron pipes. It is not an easy matter to purchase Edison electric lighting in Paris. To begin with, subscribers must bind themselves for at least three years, and must guarantee an annual average consumption of 300 ampère-hours per 10-candle power lamp for lighting, or a minimum annual consumption of 600 hours for the supply of motive power. The cost of services and internal fittings is borne by the subscriber. If a supply by meter is desired, the charge is at the rate of 15 centimes per 100 Watt-hours for lighting, and, of course, a meter-rent compared with which the hire of a gas-meter is merely nominal; or the charge is at the rate of 4·5 centimes per Carcel hour, on the rental system. Besides meter-rents a deposit calculated on the basis of 7 frs. per incandescent lamp and 30 frs. per arc lamp is exacted, without any allowance for interest.

The Woodhouse and Rawson Company have held a meeting and decided to transfer their undertaking to another Company which, as appears from the report and also from the Chairman's speech, is to unite in itself all the various concerns at present using the names of Woodhouse and Rawson, possibly to their own benefit, but certainly to the mystification of the outer world. At present there are Woodhouse and Rawson, Limited, the Woodhouse and Rawson Supply Company of Great Britain, Limited, the Woodhouse and Rawson Electric Manufacturing Company, Limited, and the Woodhouse and Rawson Electric Contract and Maintenance Company, Limited (Lancashire, Yorkshire, and Cheshire). All these are mentioned in the report of what may be described as the parent Company; and there may be more. At all events, after pending arrangements are completed, there will be only one Woodhouse and Rawson, which will be a gain in clearness if in nothing else. The Company made a 12 per cent. dividend last year; and hold out hopes of doing still better when they get all their forces into one team.

Extension of Mechanical Stoking at Beckton. — The Directors of The Gaslight and Coke Company have decided to extend the use of West's system of mechanical stoking at the Beckton works, and have entrusted West's Gas Improvement Company, Limited, of Manchester, with a large order for several sets of machinery, with engines, coal-breakers and elevators, &c., complete, of the same type as those erected for the Blackburn Corporation, which are driven by wire rope. This step on the part of the Directors has, we believe, been for some time in contemplation, and is not the result of the present agitation in connection with the eight-hours system.

A NEW WAY OF CARBURETTING GAS.

It was with mingled feelings that we heard some time since that a new gas-carburetter was about to be brought before the public. Of the making of carburetters there seems to be no end; and but for the flash success of the Lawrence gas scheme, which was nothing more than an ordinary project for enriching coal gas with the vapour of gasoline or petroleum spirit, we should not have thought it possible to awaken general interest in any proposals of this nature. It may be remembered that the only novelty in the Lawrence gas scheme was the idea that the Company should lend out their apparatus to gas consumers, supply gasoline, and undertake the management of the whole arrangement, receiving by way of payment an allowance of one-half of the amount saved upon the consumers' gas bills. There was sufficient in this proposal to recommend the system to the notice of large consumers of gas; and it is understood that a fair number of these contracts were entered into by the Lawrence Company. The results were disastrous, not on account of any fundamental defect of the share system, but because there was in reality nothing in the particular apparatus taken up by the Company—this being no more efficient as a carburetter than any of the thousand and one devices of the same order that have been placed upon the market during the past forty years. That the idea of improving the illuminating power of common coal gas to what may be called a high cannel gas standard by the addition of hydrocarbon vapour is feasible, scarcely requires to be stated. Success in such a process depends primarily upon the possibility of obtaining a suitable enricher at a sufficiently low cost; and secondarily upon its proper and convenient application. The problem has been solved in one way in the albo-carbon light. The present cheapness of gasoline, however, is an inducement to people of an inventive turn to essay the solution of the, in some respects, more difficult, and in others more inviting, problem of utilizing this liquid hydrocarbon to the same end. A fluid enricher offers more facility than a solid in respect of making the carburetting process continuous and automatic. The chief object to be attained is in both cases the same—to add to the gas a regular proportion of the enriching material, whatever the rate of consumption, and to effect this by such means that there shall be no waste. Herein has lain the weakness of the common type of carburetters using a fluid. Nothing is easier than to cause a flow of gas through or over a reservoir of volatile hydrocarbon, which results in the evaporation of the latter, and the mixture of its vapour with the gas, to the great gain of illuminating power. A tin box of shavings wetted with the fluid, and pipes for the admission and exit of the gas, are all that is required for demonstrating this action. The regulation of the action is a different matter; and it has been the drawback of the great majority of designers of carburetters that they have either not recognized the necessity for such regulation or have failed in securing it, so that the first gas passing through their machines is saturated with vapour from the most volatile portion of the liquid, and afterwards there is a gradual fall until either the whole is taken up or a residuum is left which will not evaporate. It is therefore essential that the current of gas should not be allowed to exert this selective power, which means, in the first place, that the fluid must be wholly volatile; and, secondly, that its rate of evaporation should be always proportional to the flow of gas. Before gasoline became so cheap as it is at the present time, it was difficult to get a fluid that would not leave a residuum not volatile at temperatures short of the heat of carbonization, which is a different process to that of carburetting by vapours. Even with gasoline it is a problem to feed the vapour regularly into the gas, in default of which, as already remarked, the result cannot be satisfactory. Assuming for the moment, therefore, that it is worth while to carburet gas, we want a means of doing it which shall produce at the burner a mixture of constant illuminating power, capable of being burnt from first to last by the same burners without smoking, and without depositing the enriching vapour in the pipes under any normal variations of temperature. To complete the list of requirements of such a machine, it should be easy to manage, not likely to get out of order, need little supervision, and be perfectly safe.

Such a machine is claimed to be that now in use at the factory of the Maxim-Nordenfelt Gun and Ammunition Company at Erith. It is the invention of Mr. Hiram S. Maxim; and its details and application have been worked out by Mr. Frank W. Clark. Such a combination is enough to attract serious attention to the apparatus; and our readers will judge from the following description how far the new carburetter is likely to justify the claims advanced for it, and to enhance the credit of the eminent engineers who are responsible for it. We have no hesitation in declaring that it is far in advance of anything of the kind we have ever seen, and that, whatever may be its fortunes, it presents an adherence to principles, a degree of ingenuity in design and arrangement, and an honesty of purpose deserving of all praise. When we state that its construction and performance have been unreservedly submitted to Mr. Corbet Woodall for examination, and that after a most painstaking investigation on the spot, in which nothing was taken for granted, but every point determined with a care and conscientiousness that falls little short of deserving to be characterized as excessive, Mr. Woodall has reported favourably both of the machine and its duty, we have said all that need be advanced on this score. There could not be a greater contrast between the way in which this thing is being put forward and the fashion of the catch-penny dodges which we are too accustomed to expose in connection with the launching of so-called new gas processes by unscrupulous

speculators who get their testimonials from ignorant newspaper reporters, and their victims in a gullible public. Whatever may be their prejudice against carburetters in general, gas engineers will find nothing about the Maxim machine, or its use at Erith, to awaken suspicion of trickery; but, on the contrary, they will see much in it to arouse admiration, and find food for plenty of consideration.

The machine at Erith occupies a corner of the boiler-house, being connected close to the outlet of the meter. It is bye-passed, because carburetted gas is not required by day in the works, where, by the way, gas is much used for workshop purposes. It is about 5 feet high, and 14 inches diameter outside, presenting much the general appearance of a large injector or a steam-jet exhauster; being a cast-iron cylinder of slightly different diameters in its successive vertical chambers. This sized machine is capable of carburetting at least 1000 lights; and actually serves 700 scattered all over extensive shops and offices. The lowest chamber contains a copper cylinder, called the retort. This holds the gasoline, which flows into it by gravity from a reservoir placed in a shed outside the buildings, and is at such a level as to maintain the fluid at about half the height of the retort. The retort is surrounded, when the apparatus is working, by steam or hot water, the heat of which vaporizes the gasoline. The vapour rises through a series of baffle plates in the upper portion of the retort, and escapes into the next chamber, which contains a gasholder sealed in mercury, and intended to act both as a mixing vessel for the gas and gasoline vapour and a regulator of their proportions. This is in reality the heart of the apparatus; and the way in which the gas is carburetted to any desired degree of richness is ingeniously simple. The holder works on a vertical central spindle passing through a tube open to the gasoline retort below, but ending at the top in a "stuffing-box fit," which does not permit any appreciable passage of gasoline vapour so long as the holder is grounded. As gas is admitted into the holder, however, through a suitable pipe, it of course rises and carries its central spindle up with it. This spindle is cut away in several longitudinal chases, which deepen with its length of travel, so that the higher the holder rises the more gasoline vapour rushes into it through these chases in the spindle. Thus the vapour enters from below, and mixes with the gas in the holder; and the mixture finds an exit through a number of holes in the upper portion of the side of the holder—the holes being so disposed that, the more draught there is upon the gas-outlets, the more of them are exposed above the mercury. The holder is thus a governor, or rather a rheometer, as well as a mixer; for, supposing the steam to be turned on to the retort when there is no gas passing into the holder, the latter will not rise at all. When gas is allowed to enter, the holder rises, and at the same time admits the proper proportion of gasoline; and thereafter, no matter how much the holder may rise or fall, in consequence of variations in the draught, the proportion of gasoline vapour to gas is always the same.

This leads to another branch of the subject—the fixing of the standard illuminating power. The Maxim machine can be adjusted to admit any desired proportion of gasoline vapour to the gas which passes through it, by simply varying the mercury level, so that, whether 10 or 1000 burners are drawing from it, the gas shall be always of the same illuminating power so long as the retort is kept warm, and the supply of fluid maintained in the service-tank. The question arises, What is the most convenient average illuminating power under ordinary circumstances? Complete saturation would give, with common 16-candle gas, an illuminating power of at least 60 candles. But it would be extremely troublesome to burn so rich a mixture in open burners; and there would certainly be condensation in the pipes. On the other hand, it is desirable to increase the illuminating power of the gas to such a point as shall show a distinct economy in the rate of consumption required for giving a certain effect. Mr. Clark has decided upon an average of 39 or 40 candles as the most desirable mean; and this standard Mr. Woodall certifies to have been maintained with ease for weeks together—the gas showing no appreciable difference in illuminating power whether tested close to the machine or at the most remote parts of the premises, after it had traversed long lengths of pipe both under and above ground. Neither was there any trace of condensation. This 40-candle gas can be easily burnt in an ordinary union-jet or slit burner consuming 2 cubic feet per hour, which is a useful size for factory use. Mechanically considered, therefore, the problem of regular and efficient carburetting appears to be solved by this machine.

It now remains to show that the process is worth the doing. The ordinary uncarburetted gas, with an illuminating power of 16 candles per 5 cubic feet, or thereabouts, as tested with the standard Argand, gives a light of 1·66 to 1·74 candles per cubic foot when burnt in the ordinary open burners most suitable for factory and general use. Burnt at the rate of 2·08 cubic feet per hour in a similar but smaller burner, the carburetted gas gives a duty of 6·68 candles per cubic foot—that is to say, 2·08 cubic feet gives more light than 7·6 cubic feet of uncarburetted gas burnt under similar conditions. This gain is secured by the consumption of 4·38 gallons of gasoline per 1000 cubic feet of gas. Taking the cost of gas at 3s. per 1000 cubic feet, and of gasoline at 1s. per gallon, this result represents a saving to the user of 44 per cent. The dearer the gas, of course, the greater the saving; gasoline being constant in price. Thus, at 5s. per 1000 cubic feet, the saving from the use of the enricher would be 57·2 per cent.; and, conversely, with gas at 2s. 6d. per 1000 cubic feet, the saving would be reduced to 37·1 per cent. The cost of steam or hot water for use in the apparatus is not computed, but this is insignificant; and on the other hand the value of gasoline is taken at a high figure. Altogether, it is clear that, by means of this machine, managed in the way we have described, Mr. Maxim has placed the question of the cost of gas, as compared with any other form of artificial lighting, on a new footing for the large class of consumers to whom it is an important consideration.

Gas Companies as Electric Light Suppliers.—The Manager of the Burton-on-Trent Corporation Gas-Works (Mr. F. L. Ramsden) is, on the instructions of the Gas Committee, preparing plans and estimates for the purpose of considering the advisability of introducing an electric installation to light a portion of the borough. Mr. Ramsden has for some time past called attention to the increasing demand for gas, which the works are barely sufficient to meet.

Lighting Railway Carriages by Electricity.—As from yesterday, the Midland Railway Company will run electrically lighted trains between London and Manchester and Liverpool. The system adopted is the patent of Mr. Langdon, the Company's Superintendent of Telegraphs, and is said to be a distinct advance on anything before achieved. The electricity is stored in accumulators in each carriage, so that the train may be taken to pieces and the light be still available.

Society of Engineers.—At the next ordinary meeting of this Society, to be held on Monday, the 3rd prox., Mr. H. Faija, M.Inst. C.E., will read a paper on "The Forced Percolation of Water through Concrete." It will consist of a description of the author's experiments with briquettes of cement concrete; and will comprise the history of a briquette placed under forced filtration, the quantity of water filtered through, chemical analyses of the cements used and of the briquettes after filtration, and the general deductions and conclusions arrived at.

The Lighting of Railway Carriages by Gas.—The Directors of the Buenos Ayres and Rosario Railway Company have placed with Pintsch's Patent Lighting Company, Limited, an order to supply plant for two oil-gas works, and for fittings for the whole of the rolling stock, consisting of 86 old, and 40 new carriages. The first-class carriages have 20-candle lamps; the second-class, 16-candle lamps; and the corridors, 10-candle lamps. The whole of the coaches have omnibus roofs; and the lamps (889 in number) are of highly ornamental designs. In connection with the subject of railway carriage lighting by gas, the Chairman of the above-named Company (Mr. W. B. Rickman) writes to say that the report which has been industriously circulated as to the burning of some railway cars lighted with gas in Canada is entirely without foundation; he having last Saturday received a cablegram from the Company's agent there, stating that the cars in question were lighted with paraffin, which caused the accident, and serious loss of life.

The Heating Power of Coal.—At a recent meeting of the Manchester Section of the Society of Chemical Industry, Mr. W. Thompson read a paper on the heat-producing powers of twelve samples of coal, determined by burning in oxygen (in the apparatus devised by him), compared with their theoretical values as calculated from their chemical composition. The coal which he found to give the highest results as regards producing heat was anthracite, which yielded 8340 centigrade units of heat. Next came Pendleton coal, with 7736 units; then Wigan coal, 7552 units; the lowest of the twelve coming from near Atherton, with 6448 units. The results obtained by experiment were higher in two coals than the calculated results obtained by determining by heat units given by the combustion of the carbon, hydrogen, and sulphur found by analysis, but deducting the hydrogen, which appears always to be in combination with the oxygen present, so that its hydrogen does not produce heat on burning. In two coals the heat found by calculation and that found by experiment were the same; and in seven coals the heat found by calculation was greater than that found by experiment.

Death of Sir T. Dakin.—By the death, last Friday, in his eighty-second year, of Alderman Sir Thomas Dakin, one who filled a conspicuous position in Metropolitan gas politics forty years ago was removed from amongst us. Sir Thomas was one of the leaders of the movement which resulted in the formation of the Great Central Gas Consumers' Company, of which he was Chairman down to the time of its amalgamation with The Gas-light and Coke Company in 1870. The deceased gentleman was the oldest member of the Corporation, having entered it in 1843. He became Alderman of his ward (Candlewick) in 1861, served as Sheriff in 1864, and was Lord Mayor in 1870. He was one of the Conservators of the River Thames and a member of the Court of the Fishmongers' Company. It was in the discharge of the duties of the former office that he met with the accident which caused his death. The late Alderman's mayoralty was rendered notable by the large funds raised at the Mansion House for the succour of the besieged residents in Paris after the Franco-Prussian War and the horrors of the Commune, as well as for the relief of the sufferers by the fire at Chicago, the hurricane at Antigua, and the famine in Persia. At the close of his year of office he received the honour of knighthood; and the French Government bestowed on him the highest grade of the Legion of Honour which a foreigner could receive. He was also decorated with the Belgian Order of Leopold. In politics he was a Liberal; and he twice unsuccessfully contested a seat in Parliament. He leaves a widow and four daughters.

Notes.

A Fire Damp and Coal Gas Indicator.

At the recent *conversazione* of the Royal Society, a new description of fire damp meter was exhibited by Mr. James Pitkin as the invention of himself and Mr. Niblett. By means of this instrument it is possible to detect and estimate the percentages of oxygen and hydrogen in mixtures of these gases. In its simplest form it consists of two ordinary cylindrical-bulbed mercurial thermometers mounted on a suitable base and graduated in the usual way to the Fahrenheit or Centigrade scales. One tube registers the temperature of the gaseous mixture in which the instrument is placed. The other, which is the gas indicator, has its bulb coated with one of the metals which, when in a finely-divided state, occlude and facilitate the chemical combination of certain gases. The effect of this action, when taking place on the bulb of a thermometer, causes a rise of the mercury due to the heat developed by it. To read the instrument, the difference between the indications of the two mercury columns is taken and referred to a table supplied with the instrument, which gives an equivalent number representing the percentage of the gas present. In the case of a mixture of fire damp or coal gas and air, the amount of heat developed by the occlusion of the hydrogen on the coating of the mercury bulb appears to correspond approximately with the explosive activity of the mixture. A sliding scale may be fixed to the instrument, which can be graduated in terms of percentages of any particular gas. At present, the chief use of the instrument is in connection with the same purposes for which diffusiometers have hitherto been employed—that is to say, for detecting fire damp and coal gas in the air of confined spaces.

Lightning and Gas-Pipes.

A paper on "Lightning, Lightning Conductors, and Protectors" was recently read before the Institution of Electrical Engineers by Dr. Oliver Lodge, in the course of which the influence of gas and water piping in buildings was discussed. Reference was made to a number of incidents recorded in the Transactions of the Lightning Rod Conference, when lightning has affected gas-pipes in different ways. It was remarked that the existence of gas-pipes makes houses more difficult to protect, and in fact causes dwelling-houses to require almost as much protection as powder magazines. In July, 1880, during a heavy thunderstorm, a 400-light dry meter of a mill, although locked up in a cellar, with no light near it, exploded, and the gas coming from a 4-inch main was ignited. A year later a similar accident, under parallel circumstances, occurred in the same place. Professor Kirchhoff has remarked that the introduction of a mass of metal into a building in the shape of gas or water pipes, occasionally has the effect of neutralizing the previously established lightning rods. Professor Kirchhoff states that he knows of no case where lightning has destroyed a gas or water pipe which was connected with the lightning rod, although he knew of cases in which the pipes were destroyed by lightning because they were not connected with it. Finally, he mentioned two cases of lightning striking rods closely united with the gas and water pipes. In both cases the lightning rod, the building, and the pipes, were uninjured. After reviewing all the evidence, Dr. Lodge comes to the conclusion that a good and deep earth should in general be provided, independent of the gas and water pipes. If the conductor at any part of its course goes near water or gas pipes, it is best to connect it to them. If the place to be protected has gas or water pipes inside it, the conductor should be connected to the mains underground. At all places where water and gas pipes come near each other, and, in general, wherever one metal ramification approaches another, it is best to connect them metallically. The neighbourhood of small-bore fusible gas-pipes should be avoided in erecting a lightning conductor. Into powder magazines and such-like places no gas or water pipes should be permitted to enter, unless the whole building is made of metal, and they are elaborately connected to it at the point where they enter. The cheapest way of protecting an ordinary house is to run common galvanized-iron telegraph wire up all the corners, along all the ridges and eaves, and over all the chimneys, taking them down to earth in several places, and at each place burying a load of coke. After all, it is difficult to say of any building that it is perfectly protected from lightning, for lightning is constantly doing unexpected things.

Loose Rivets.

In one of a series of articles on "Metallic Construction," a writer in the *Builder's Reporter and Engineering Times* says that a rivet, more than any or all other forms of fastening, is used in connecting the parts of iron and steel structures, and it is doubtful if anything will be ever devised to take its place. Nevertheless, as at present used, rivets are subject to certain defects and accidents of workmanship which it is the business of an inspector to detect, and of the engineer to remedy or prevent. Perhaps the most important of these drawbacks is the liability of rivets to looseness. The office of almost all the rivets in a structure is to carry transverse shear. Now, if a rivet is loose—that is, if its shank is separated by any appreciable space whatever from the sides of the hole which it is supposed to fill—it is evident that it cannot take up any shearing strain from the pieces which it connects, and that consequently the hole might as well be empty. In a general way it is permissible to say that hand riveting is more likely to be loose than machine riveting; and, moreover, the looseness is liable to be more irregular—that is to say, that supposing an equal number of rivets to be loose in each of two members, one hand and the other power riveted, the loose rivets in the former are likely to be scattered over the member while in the latter they will probably occur in groups and series. Counter-sunk rivets are more likely to be loose than those with ordinary projecting heads. Whether rivets counter-sunk on both sides are more frequently loose than those with one full head may be considered doubtful, as it is almost impossible to test double counter-sunk rivets for looseness. However, such rivets will frequently move longitudinally in the holes, which is not the case with most full-headed rivets. Rivets connecting thick plates are more likely to be loose than those in lighter work. Rivets holding lattice bars or light cover plates to flanges of channels, &c., are seldom loose. If, however, a rivet passes through two or more thicknesses of metal besides lattice bars, or a cover plate, its liability to looseness is increased in proportion to the extra thickness of metal passed through. Pin plates, or other reinforcing plates, especially when fastened by staggered rivets close together, are likely to have some loose ones. In general, the closer the rivets together, the more apt are some of them to be loose. In long, regularly-spaced rows the rivets are less apt to be loose than when crowded or bunched. In rows of rivets those at or near the ends are most likely to be loose. When the last rivet of a row is tight, a loose one may frequently be found second or third from the end.

Communicated Articles.

THE CHEMISTRY OF ILLUMINATING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

XIX.

It is a remarkable fact that each constituent of an illuminating gas has some effect upon its value. A guarantee as to the quality or value of the illuminants, as represented by the matters absorbable by bromine, is therefore in no sense a guarantee of the quality of the gas. That will be affected by the composition of the non-luminous agents—as hydrogen and carbonic oxide. The presence of nitrogen, carbonic acid, and other incombustible gases is also found to have an important influence, for they do not behave merely as harmless diluents, reducing the illuminating value of the mixture in inverse proportion to the percentage in which they are present, but they have a positive or antagonistic effect. For example if we mix 5 per cent. of incombustible diluent with a sample of gas, the illuminating value of the sample will be reduced to an extent considerably exceeding 5 per cent. This is found to be the fact with all kinds of illuminating gases, and is of great importance in practice. Whenever it is proposed to make a rich gas and dilute it with air or nitrogen, there is a certain amount of waste. The same applies, though to a less extent, if the diluting agent is a poor or a non-luminous gas. No illuminating gas can be diluted without a loss of lighting effect; and such a course is only practicable, as a successful commercial operation, when the enriching material is cheap. In certain parts of America, for instance, where crude petroleum is obtainable at less than 1d. per gallon, it will pay in practice to make a rich oil gas, and bring it down to 20-candle quality by loading it with as much water gas or such like diluent as it will carry. But it is found in practice that some five gallons of oil are used per 1000 cubic feet of gas; and this alone is sufficient to convince practical gas makers that oil must be very cheap, or else that gas coal must be very dear, to enable such a course to be attended with financial success. It will be necessary, in order to arrive at a clear idea of the relative value of various kinds of gas, to go beyond mere generalities, such as specific gravity, percentage of illuminants, &c. The constitution must be considered as a whole, with an intelligent appreciation of the effect, not only of the illuminants, but of each constituent, upon the general result. The illuminating effect yielded by the gas is an aggregate of several factors, some positive, and some negative.

There is reason to believe that the effect of the combustible but non-luminous diluents is intimately connected with their temperature producing capabilities per unit of volume; although the experiments that have been tried in this direction are too few in number to afford anything like conclusive evidence in favour of such a supposition. The temperature producing capability per unit of volume, it must be observed, is a very different thing from the thermal value as indicated by the calorimeter, which is usually expressed in units of weight. A substance may be capable of producing a large quantity of heat, but at the same time it may happen that the specific heat of the products of combustion is high; and therefore the actual temperature producing power may be less than that of a substance yielding a smaller quantity of heat, but also products of combustion having a lower specific heat.

It is frequently remarked that hydrogen is of much more use in illuminating gas, as a diluent, than carbonic oxide, because of its greater heat-producing power. This remark is based upon some confusion between weight and volume. The usual method of expressing calometrical values is in terms of weight. One pound of hydrogen is capable of producing about 62,500 units of heat; whereas 1 lb. of carbonic oxide only yields about 4480 units. But the constituents of illuminating gas are usually dealt with by volume and not by weight. Hydrogen is so light that 1 lb. of it measures 190 cubic feet or so in bulk, and therefore the heat-producing power of 1 cubic foot is 62,500 ÷ 190, or only about 330 units.

Carbonic oxide, on the other hand, is much heavier. A cubic foot comprises only 13·6 cubic feet; and therefore the heating value of a cubic foot of carbonic oxide is 330 units, or the same as with hydrogen. In order to get at the temperature, however, we must look at the products of combustion, and their specific heat. These are 1 cubic foot of water vapour in the case of hydrogen, and 1 cubic foot of carbonic acid from the carbonic oxide. The specific heat is 0·023 for the water, and 0·024 for the carbonic acid, respectively. So the maximum temperature obtainable from hydrogen is 330 ÷ 0·023 = 14,400°, and that from carbonic oxide, 330 ÷ 0·024 = 13,660°. Hydrogen is therefore slightly the better of the two, but not to so great an extent as is supposed. It is also evident that the frequent assumption to the effect that the presence of a large proportion of hydrogen in coal gas must necessarily mean the production of an enormously large quantity of heat, as compared with other mixtures that are poor in hydrogen, has no foundation in fact. As another example of temperature producing power, as distinct from quantity of heat, we may compare the filament in an incandescent electric lamp with the flame of a gas-burner. In each case the temperature may be about the same; but the difference in the relative quantities of heat is very marked.

Flame temperature, however, is only one factor, although an important one, amongst others. The density and other properties of the products of combustion, as affecting that of the media in which light is produced, are also concerned in the matter. If we accept the general opinion that the light is caused by the presence of highly-heated solid particles of carbonaceous matter, it may be expected that the actual quantity of light evolved by each particle, during its very ephemeral existence, will be largely affected by the nature of the environments in which that existence takes place. The light is produced by a rapid succession of births and deaths—so rapid as to appear continuous to the eye—of particles of carbon. And the actual value of the contribution of each particle to the general effect, will not only depend upon the temperature to which it is raised, but on the length of the life of each particle, which may or may not be affected to an important extent by the nature of the media. The longer the life of each individual particle, the greater the number in existence at any one instant; and therefore, all other things being equal, the greater will be the luminosity of the flame. It would be idle to pursue these speculations further, because very little is known about the actual cause of the luminous properties of flame, and therefore many different opinions exist about them. Some dispute the connection between the presence of solid particles in the flame and illuminating value, and are inclined to consider the density of the flame producing media as chiefly concerned in the production of light.

Professor Anderson directed his attention to the part played by hydrogen and carbonic oxide, as constituents in illuminating gas.* He prepared them in a pure form, and observed that when consumed at the rate of 5 cubic feet per hour in an ordinary Argand burner, they yielded short, practically non-luminous, blue flames, about 1½ inches in height. He also examined the residuum left after the removal of the absorbable hydrocarbons from coal gas†, as represented by a mixture of 41 parts each of hydrogen and methane, 11·5 of carbonic oxide, 2·1 of carbonic acid, and 4·4 of nitrogen. In respect to this mixture, it should be observed that coal gas usually contains a notably higher percentage of hydrogen than of methane, only about one-half the proportion of carbonic oxide ascribed to it, and certainly less than 2 per cent. of carbonic acid. The absence of hydrocarbons was proved by agitation with bromine, which failed to reduce the volume of the mixture. When tested at the photometer, this gas failed to indicate any illuminating value whatever. It produced a dull blue flame about 2 inches high. Apparently it was conjectured that this result was due to the injurious influence of the carbonic acid and nitrogen. A mixture of 20 per cent. of carbonic oxide, 2 per cent. of carbonic acid, 62 per cent. of hydrogen, 6 per cent. of nitrogen, and 10 per cent. of ethylene was next tested; this also failed to give any illuminating value. But this gas was really richer than ordinary commercial gas, and therefore we must look a little further for the explanation of the fact that it was practically non-luminous. The explanation is, I think, to be found in the fact that the mixtures were allowed to stand for 18 hours in a gasholder to ensure complete diffusion. In order to keep them from the influence of the water, a small quantity of oil was added, which formed a protecting film on the surface of the water. Professor Anderson was apparently unaware that the oil would actively absorb the ethylene. As a matter of fact, the mixture that remained from the trial must have been practically devoid of this illuminant, and consisted merely of hydrogen and carbonic oxide, together with the incombustible diluents. In a third experiment, a sample of 13-candle gas was passed through a series of three Liebig's bulbs, charged with fuming sulphuric acid, and then through two tubes containing lumps of pumice washed in potassa solution, for the purpose of absorbing acid fumes. This mixture gave a short blue flame at the photometer burner, devoid of illuminating value.

Professor Anderson found the illuminating value of methane in a pure form was 20 candles for 5 cubic feet; but appears to have considered that this result might have been due to the presence of other hydrocarbons.‡ He proceeded to prepare a fresh supply of the gas; but this time it was first cooled and washed in potassa solution, then passed through a series of nine U-tubes charged with fuming sulphuric acid, and finally passed over broken pumice stone soaked with potassa solution, to absorb acid fumes. Unfortunately this gas was not tested by itself. When mixed with ⅛th part of carbonic oxide and ⅛ths of hydrogen, and also with a less proportion, the mixtures were utterly valueless as light producers, but the experiments do not show whether this was due to the diluting effect of the hydrogen and carbonic oxide, or to the fact that the illuminating value of pure methane had been overstated. The flame from these methane mixtures is described as possessing remarkable characteristics. It consists of three distinct zones, the lowest of which is a dull blue, and similar to that observed just above the burner in a coal-gas flame. The next is of a dull whitish tint; and the third, or upper zone, is reddish pink, and occupies the portion of the flame which usually evolves light in coal gas. The flame with the Argand burner was about 2 inches high; and these peculiarities are best shown by using a fishtail or batwing burner.

Dr. Frankland, in the course of a series of lectures on coal gas, delivered at the Royal Institution in 1867,* calls attention to a remarkable property possessed by methane, which is peculiarly interesting at the present time, when so much attention is being directed towards burning gas on the regenerator principle, and thus obtaining increased duty from it. Having remarked that under the ordinary circumstances of gas consumption, no illuminating value is obtained from this constituent, he showed by means of an experiment, that if either the methane or the air supplied to it was strongly heated before reaching the point of combustion, a flame of considerable illuminating value was obtained. He considered this to be one of the causes of the great increase in illuminating effect that may be obtained by heating the air before it comes in contact with an ordinary gas-flame. It scarcely appears feasible, however, that this property should be peculiar to methane, but rather that it is common to all the hydrocarbons. Dr. Frankland considers hydrogen to be preferable to methane or carbonic oxide, on the whole, as a combustible diluent of coal gas. It is perfectly non-poisonous in itself, and its product of combustion is also non-poisonous. It does not produce so much heat as the other gases named; but it is more likely to produce an explosive mixture with air if it escapes in an unburnt state, as the range of explosiveness in mixtures of hydrogen and air is much wider than that of mixtures of methane or carbonic acid with air. Methane is also non-poisonous, but it consumes a large proportion of oxygen—twice its bulk; and generates carbonic acid as a product of combustion; and also a great deal of heat. Carbonic oxide is not merely objectionable as a producer of carbonic acid, but especially because it is excessively poisonous. The presence of only 2 per cent. of it in the atmosphere would probably produce a mixture fatal to life.

* See JOURNAL, Vol. XIII., p. 345. † *Ibid.*, p. 430. ‡ *Ibid.*, p. 842.

WATER SUPPLY BY MEASURE—AN EXPERIMENT.

By METER INSPECTOR.

I wish to lay before readers of the JOURNAL the following particulars as to probably the only instance in the United Kingdom of a community being supplied with water by measure.

The township consists of 80 houses, supplied through 41 meters. The water is purchased at 1s., and vended at 1s. 3d. per 1000 gallons. All the meters are inferential, and of the best description. This experiment has quite recently commenced; and the first precaution was to take a correct reading of the supply meter, then to sound and inspect all the pipes and fittings, and read the consumers' meters—noting all breakages and defects, some of which were causing great waste. All the pipes were repaired at once; and, as far as could be insisted on, the fittings were put in order. On the seventh day after the commencement of the trial, the whole of the meters were again read, and another inspection made, when there was found to be a difference of 50 per cent. between the consumers' and the supply meter. This is to be very readily accounted for in this instance, as six meters were stopped entirely, but still a sufficient supply for the consumers' requirements was passing the meters; four meters had joints leaking; one meter was sent away for repairs, and a pipe jointed temporarily to continue the supply; one meter burst owing to frost; seven pipes and cocks burst and were leaking; and fourteen meters were slow (the consumption not being sufficient to work them) and requiring repairs, &c.

Ordinary iron and some galvanized iron pipes have been used, laid in a clayey soil. The meters are owned by the tenants and landlords. Some of them are fixed in the most abominable places—the pits being full of filth, &c.; others in the most inaccessible places, such as under floors and in cellars, &c., out of the way of the inspector. This is an exact description of what would occur if the Bill to sanction the supply of water by measure had passed the People's Parliament in 1884. Here is a small population, in which consumers are allowed to have their own meters and fix them where they please; and so long as they can procure a sufficient quantity of water, no power can insist on them repairing the instrument. It is their own property; and they are quite satisfied with its performance, inasmuch as some of the occupants of houses at a rent of £40 per annum pay for their water supply 1s. 3d. per quarter. At this rate the pipes and cisterns can never be flushed or cleansed, and many of the water-closets are cut off because they are wasteful. Water cannot be pumped and distributed through many miles of mains without carrying a certain amount of sediment; therefore, the water remaining in any kind of pipe overnight should be drawn off in the morning before being used for drinking purposes, and every cistern cleansed at least once a

* See JOURNAL, Vol. XVI., p. 327.

month. No precautions are used in the place to which the foregoing particulars apply; and the sanitary authorities, in the usual way, sum up the death-rate, and find it a little excessive, but not so high as in some places.

Water may be sold by meter in a superior manner to that here described; but then the following conditions must be observed:—The consumer must not be allowed to own the meter. There must be a minimum rate sufficient to recoup the water company for their outlay. The meter must be fixed in an accessible place, so that it may be changed quickly. The rate per 1000 gallons cannot be so fixed by Act of Parliament that it shall apply to all companies, nor the rent that should be charged for the instrument. The supply of water under pressure cannot in any way be compared to a supply of gas. Water-meters *must* be read once a month at least, and changed every two years. After all these considerations have been taken into account, many of the poor and parsimonious people will be found to drink stale water; and dirt and disease will prevail to a greater extent than at present. It is recommended that the low-pressure meter should be placed over the cistern, and every drop of water will be measured. The cistern is usually placed in the roof; it is without a lid; and the water is covered with soot and dust. There is no one in the house capable of getting up to this inaccessible place; consequently the cistern is never cleaned out. Or the low-pressure meter is fixed over a cistern to measure every drop of water. In London, when travelling by rail, we see the cistern over the water-closet, with the water as green as grass; and we fancy what must be the "drip, drip," into this abominable receptacle.

Water will not remain bright and fresh in the pipes unless it is kept in circulation; and this cannot be effected by consumers of limited quantities using a small-sized meter. The consumer must be allowed to have the free use of the tap, without restraint or fear of charge.

Mr. Gadd's System of Gasholder Construction.—The contract for the two-lift holder, on Mr. W. Gadd's spiral system of guiding, which, as stated in the Journal some weeks ago, is about to be erected at the Northwich Gas-Works, from the designs of Mr. T. Newbigging, C.E., has been placed with Messrs. Clayton, Son, and Co., Limited, of Hunslet. Very good progress has already been made with the tank, which is expected to be ready for Messrs. Clayton by the end of next month or the beginning of July; and the holder will probably be finished by September. As this will be the first holder erected on Mr. Gadd's system, its performance when completed will be watched with interest.

High-Power Gas-Engines.—With reference to the remarks of Mr. Graham Harris at the Society of Arts, on Monday evening last week (reported in a paragraph which appears elsewhere) to the effect that gas-engine makers are too busily engaged on the manufacture of small engines to allow of their devoting a great deal of attention to the production of large ones, it may be mentioned that Messrs. Crossley Bros., Limited, have just completed two pair of double-cylinder engines for a paper-works at Godalming, which are the largest and most powerful gas-engines yet constructed. Each pair of engines is of 100-horse power, and they embrace a number of improvements; the chief being a new tube ignition arrangement, dispensing with the slide ignition-valve. With regard to economy of working, these engines, which are driven by Dowson gas, are guaranteed to work with a consumption of coal not exceeding 1½lbs. per horse power per hour.

Presentation to Mr. E. A. Loam.—The workmen employed in the Stalybridge Corporation Gas-Works recently made a presentation to the Engineer and Manager (Mr. E. A. Loam), on the occasion of his marriage. The gifts consisted of a beautiful set of vases for Mrs. Loam, and a silver-mounted briarwood pipe for Mr. Loam. They were presented by Mr. M'Dermott, who expressed the united wishes of the workmen for the health and happiness of both recipients. He remarked that during the time Mr. Loam had been with them, he had evinced a kindly spirit, which had won their respect and esteem; and it gave them pleasure to endeavour by the presents to manifest their appreciation of it. Mr. Loam, in reply, assured the donors that their beautiful gifts would be highly prized by himself and his wife; and that he personally would value these tokens of the men's kindness the more on account of the short time he had been associated with the undertaking in which they were all engaged.

Oil and Water Gas.—A demonstration was given last Wednesday with Biddison and Darby's oil and water gas system—an appliance for burning petroleum combined with superheated steam. The apparatus consists of a nest of tubes placed in a shallow iron dish; one portion of the tubes being for the oil, and the other portion for the water. Each portion is respectively connected up with a small cistern of oil on the one hand and of water on the other. To start the furnace, some petroleum is run into the dish and lighted, a little water being sent into the steam generator. As soon as steam of a sufficient temperature has been generated, oil is admitted and unites with the steam in a mixing chamber to form the gas. This gas issues from the burner, which consists of a perforated tube placed in the dish. The gas, being lighted from the flame of the oil in the dish, goes on producing steam, which is superheated and mixed with the oil; the production thus being continuous. The system was shown applied to a kitchen range, a saddle boiler for heating purposes, and a portable engine, which was driving a mortar-mill with good results as regards maintaining heat.

Technical Record.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Fresh ground was broken by the Manchester District Institution in its excursion meeting last Saturday. A few years ago the Association visited Clitheroe, and had a delightful day in the beautiful district of which that historic borough is the centre. This time the journey was continued over the border-line into Yorkshire; and the day annually given up to pleasure was spent amid some of the lovely scenery round Settle. About thirty members and friends met at Manchester, and travelled thence by saloon carriage to Settle. Additions were made to the party on the journey, and upwards of forty assembled at the Ashfield Hotel, Settle, where luncheon was served. Conveyances were then ready, and a drive was taken to the village of Clapham, which, in addition to the charm of its situation, is interesting as the birthplace of Sir Michael Faraday, whose father once worked there as a journeyman blacksmith. The drive was not the least memorable feature of a wholly pleasant day. All along the route a succession of beautiful views presented themselves, embracing towering limestone crags, whose base was frequently hidden by trees, and magnificent sweeps of undulating country above which towered the dark grey and brown peaks of Pendle Hill, Ingleborough, and other heights of the Pennine range. A halt was made at an ebbing and flowing well, which is one of the sights of the neighbourhood. The spring which flows into a basin at the foot of Giggleswick Scar has a curious intermittent action—due, it is supposed, to the existence in the rock of passages, which act on the principle of a double syphon, and cause a more or less regular rise and fall of the water. On arriving at Clapham, the party left the vehicles and proceeded on foot through a beautiful stretch of park-like country to Clapham Cave, famous for its size and the beauty of the stalactites and stalagmites which are found in its winding galleries. The whole length of the passages from the mouth to the extreme end is about one-third of a mile; and throughout the greater part of this distance there is a succession of stalactites, some of which are of considerable size, and, of course, of great antiquity. The process of formation still goes on, though it is exceedingly slow, for some little points not more than ¼ inch in length were said to have taken 40 years to form, notwithstanding that the dripping and trickling of the water which finds its way through the limestone is steady and unceasing. A little stream of water trickles through the cave, forming pools at intervals. The air is pure, and the temperature was said to remain constantly at 48° Fahr. After the cave had been explored, there was time for little else than a return to the vehicles and the drive back to Settle. The return journey was not less pleasant than the outward one had been. Tea, which was in readiness, found the party with appetites sharpened by the drive. All business was, by common consent, adjourned to a future meeting; the members separating immediately after tea, and spending half-an-hour rambling about the village. At half-past seven the homeward journey was begun; and Manchester was reached about two hours later. The weather was bright and pleasant; the arrangements for the excursion perfect; and the day one to be long remembered. Great credit is due to the Honorary Secretary (Mr. Samuel S. Mellor, of Northwich), for the attention paid to the comfort of all present.

WATER GAS.

By J. Ferguson Bell, of Stafford.

[A Paper read before the Midland Association of Gas Managers, May 16.]

(*Concluded from p. 950.*)

Manufacture of Water Gas.—I have here sketches of five different producers as employed in making water gas. I have selected three which are chiefly used in America; and the other two on account of the attention that is being directed towards them in England. One feature, which must strike everyone, is their similarity; and I could have obtained several others with but slight differences in construction, just as any gas engineer could obtain a large number of retort-settings, each no doubt having its supporters.

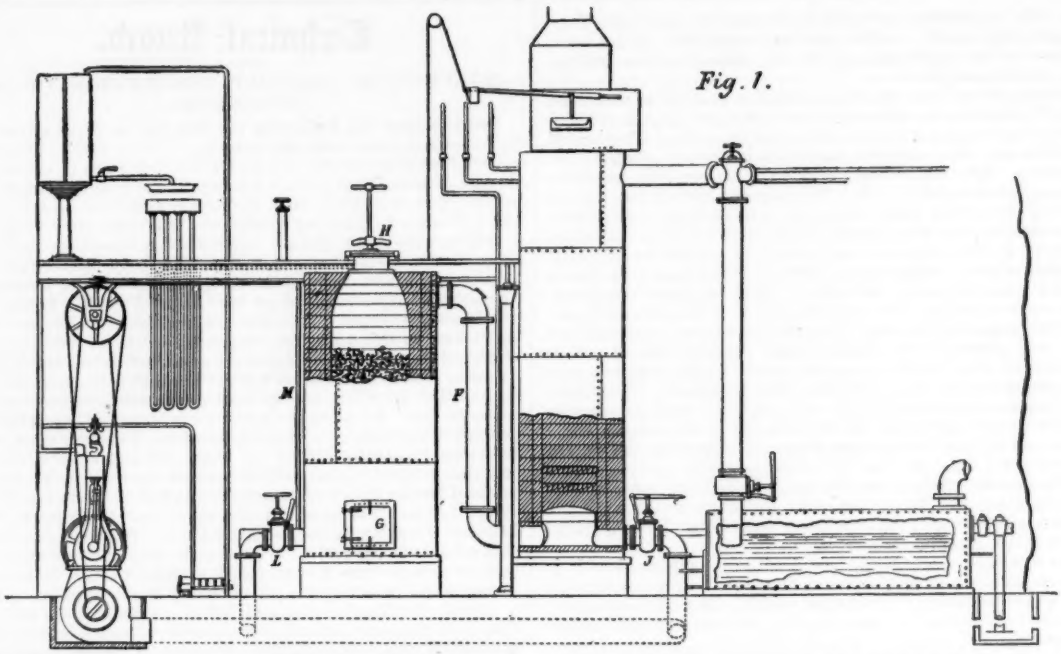
Fig. 1 (next page) is an ordinary vertical wrought-iron cylinder, lined with fire-bricks. H is the charging door at the top; G, a cleaning out door; L, the valve for the air-blast; M, a steam-pipe which enters at the bottom; and F, a pipe which takes off all the gases produced. The hot gases, after passing through the carburetter, are allowed to escape; air being admitted by the valve J to perfectly burn them.

Fig. 2 is very similar to fig. 1; air and steam being alternately forced in at the bottom of the generator, and oil for carburetting the gas being allowed to run in at the top when water gas is being made. The gases are then sent through two fixing chambers in this plant—these having been previously heated by means of the hot gases passed through them; air being admitted to complete combustion before passing them into the atmosphere.

Fig. 3 is a producer which is best adapted for good anthracite coal, for it is shallow as compared with the others, and has a shaking grate lever L to clear the generator of ash, &c., without opening the cleaning-out door. In this plant the oil is sprayed into the fixing chamber K, and in passing up through the hot fire-bricks the mixture becomes a permanent gas.

Fig. 4 is the producer employed at the Leeds Forge; and you will notice that it is very similar to those shown in figs. 1 and 2. In

Fig. 1.



this case the air-blast is passed in at the bottom, and the steam, when making water gas, at the top.

Fig. 5, like the preceding one, has a water-ring to cool the bottom part of the generator; and, as in the case of many generator furnaces in gas-works, the bottom is solid, with an air-space left instead of ordinary fire-bars. A small generator of this description has been erected by Mr. Wilson, at Stafford, to supply his house, &c., with water gas.

From what I have said, it will be seen that *no possible patents for the manufacture of water gas can be obtained at this late date;* it would be just as reasonable to apply for patents to make coal gas. A patent is virtually a contract between the Government and the inventor, under which the latter gives the public something new, and protection is granted to him, so that he can reap the benefit of his skill. But surely no one can say that water gas is a new thing. Patents only for some special contrivance or manipulation bearing upon the manufacture of this gas would be granted by the Patent Office.

The *modus operandi* of making water gas is to nearly fill the producer with anthracite coal or gas coke, heating the same up to a high temperature by means of an air-blast, which is obtained by a fan or a jet pump, which is similar in action to the blast-pipe used in locomotives for producing a draught. The valves are then reversed, and steam is injected for five or ten minutes, depending on the plant and fuel used. Then the steam is shut off, and the fuel again heated up by the forced draught. The valves are generally so arranged that the act of shutting one opens another, so that no mistake can arise through the carelessness of the man in charge. When steam is passed through incandescent fuel, it is decomposed. The hydrogen is liberated, and the oxygen combines with the carbon, forming first carbonic acid and ultimately carbonic oxide; the result being a gas of about the composition given in Table B (see *ante*, p. 949). If the gas is required for illumination, it is carburetted by means of naphtha; for ordinary water gas burns with a blue flame, and can only be utilized for lighting purposes by being carburetted, or else used to raise some material to incandescence by means of one of the incandescent burners now before the public. In America, when water gas is used for lighting purposes it is carburetted by naphtha, which is allowed to flow gently into the generator, or is sprayed direct into the fixing chamber (a wrought-iron cylinder lined with fire-bricks, and filled with the same material), so arranged that the gases can pass, but in doing so are split up and come well into contact with these hot fire-bricks. The mixture, in passing through this chamber, which is heated by means of the hot air-blast gases, and into which a supply of air is admitted to complete combustion, is thus converted into permanent gas having an illuminating power of about 18 to 20 candles. These mixed gases then pass through scrubbers, condensers, and on to the purifiers, &c., in a similar way to ordinary coal gas.

The naphtha required for carburetting is from 5 to 5½ gallons per 1000 cubic feet of gas made, and it costs in the United States about 5 cents per gallon. The cost of this item alone will therefore be 25c., which in England means at least 15d. per 1000 feet. This, of course, must be taken into account when calculating the cost of water gas for lighting purposes; for I have not much opinion of incandescent burners for general use. The Fahnejelm incandescent burner for using water gas consists of thin magnesia rods suspended by a wire over the burner, and thus forms a comb which is heated to whiteness, producing a bright light. This burner was brought out in the United States some four years ago with a great flourish of trumpets; and a Company was formed, which I understand has now dropped out of existence, the promoters only making money—which, alas, is too often the case in this speculative age. Magnesia

Fig. 2.

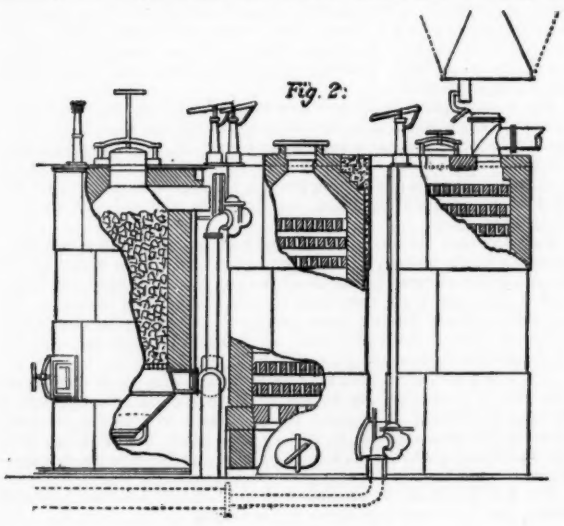


Fig. 3.

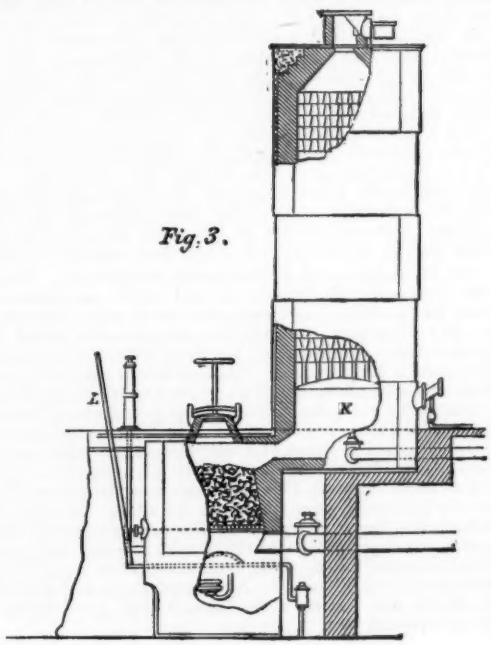


Fig. 4.

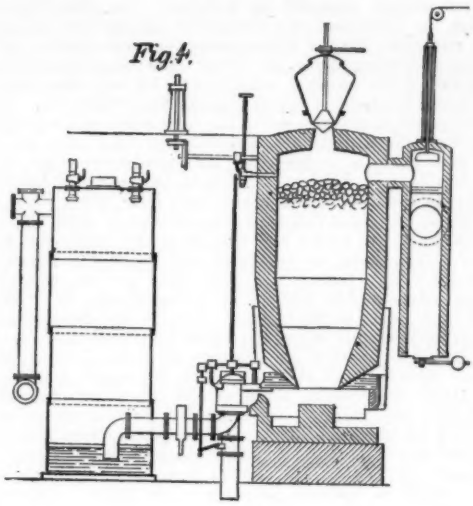
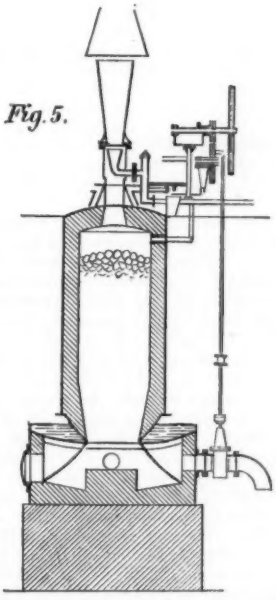


Fig. 5.



rods are far too frail, and I do not know a place in America where they are being used to any extent at the present time; indeed, it seems as if this system has to come to England to be appreciated. Probably further experience will prove that these burners are not just all that they are pictured to be; and, as a rule, the general public will not be bothered with any arrangement which requires much attention and frequent changing, as is the case with these frail combs.

Cost of Water Gas.—The cost is the crucial point with all commercial enterprises; and if water gas can be sold at anything approaching the price stated, it must, notwithstanding its defects, become a valuable adjunct to coal gas. In order to ascertain the approximate figure at which it can be manufactured and sold in England, I have apportioned the cost of the various items for both coal and water gas. Everyone can then apply the figures to his own particular district; for no doubt the items will vary somewhat in each case. The gases made when heating up the generator, which have been dubbed "producer gases," I have simply supposed to be utilized in generating the steam required on the works; for no one who has any knowledge of the subject would dream of trying to distribute a mixture of coal, water, and producer water gases for lighting purposes. The cost for carburetting alone is prohibitive, and the temperature of combustion too low for such a mixture to be used with incandescent burners; and I am of opinion, as already briefly indicated, that the large percentage of the total calorific value lost per cubic foot in dissipating the sensible heat of such a mixture is a serious item when the thermal value is so low. Thus the distribution of such a bulky fuel of low intensity would in very few instances pay for duplicate plant, mains, &c. If a mixture of the three gases named would not pay to distribute, much less would a mixture of water and producer gases pay; for the loss in proportion to the thermal value of the fuel would be greater and the mixed gases of still less calorific value.

In estimating the cost of new gas-works, I have assumed the works to be capable of producing 100 million cubic feet of gas per annum; and the capital per ton of coal carbonized would, under the most favourable conditions, be not less than £3 10s. for works of this size. But it must be distinctly understood that for smaller works the capital charges will increase considerably. The amounts are made up as follows:—

Land, retort-house, ovens, &c.	£0·80
Engine and boiler house, exhausters, boilers, condensers, washers, scrubbers, purifiers, &c. .	0·50
Meter-house, station meter, mains and valves on works, workshop, offices, stores, tools, &c. . .	0·60
Gasholders, tanks, &c.	0·60
Distribution—mains and services	1·00
Capital per ton of coal used per annum . .	£3·50

The above will apply for a coal or water-gas works; for we should require practically the same plant, with the exception of the retorts, which would be replaced by producers, and the gasholders need not be so large. Against this, however, the mains and services would require to be of greater capacity; and it is well to note that upwards of one-third the total capital is invested in the distributing plant. I prefer to under rather than over state the cost of water gas, and will consider two-thirds of the low figure of £3 10s. per ton of coal used to be the capital for water-gas works.

We know that 10,000 cubic feet of about 17-candle gas can be produced from one ton of gas coal; and we found that 23,000 cubic feet is the quantity of water gas that can be made from a ton of ordinary gas coke, or 31,500 cubic feet from good anthracite coal. If we estimate the price of gas coal and coke at 10s. per ton delivered free on the works, these will be fair average prices for a large number of places in England. On the basis and prices given, I purpose calculating in detail the cost of manufacturing coal and water gas. The figures given for expenses in manufacture, distribution, &c., for coal gas are what they have actually been at the Stafford Gas-Works during the last twelve months.

	Cost of Coal Gas per 1000 Cub. Ft.		Cost of Water Gas per 1000 Cub. Ft.
Manufacture (this includes gas making, purifying, repair and maintenance of works, &c.)	6·0d.	one half of this amount . .	3·0
Distribution (this includes repair and maintenance of mains, services, &c.). . .	2·0	. . . . .	2·0
Rates and taxes	2·0	. . . . .	2·0
Management	0·8	. . . . .	0·8
Total working expenses . .	10·8d.	. . . . .	7·8
Coals—10,000 cubic feet of gas—at 10s. per ton, less 65 per cent., being the net amount received for residuals, leaving the net cost for coal 3s. 6d. per ton . .	4·2	Coke—23,000 cubic feet of gas—at 10s. per ton, with no residual products . .	5·2
Total coals and working expenses	15·0	. . . . .	13·0
Interest on capital, £35,000 at 5 per cent.	4·2	two-thirds of this amount .	2·8
Depreciation and renewal funds	1·8	. . . . .	1·2
			17·0
		Add cost of naphtha for carburetting the water gas, so as to make it burn with a luminous flame without external aid (allowing for extra quantity of gas made by the naphtha)	13·0
Total cost for 1000 cubic feet	21·0	. . . . .	30·0

The foregoing are hypothetical cases, and (where no disturbing factors arise) represent about the lowest price at which coal or water gas could be sold to pay a return of 5 per cent. on the investment. But in the majority of places the gas-works have been built a number of years, and the invested capital is thus about double what modern works could now be erected for, under favourable conditions. Thus capital charges are double the amount set down; ably exceeds 1s. 9d. per 1000 cubic feet. Further, the various and hence the price charged for coal gas in most places considerer amounts put down for working expenses, and especially the net cost of coals, are much lower than most works can obtain their coal for, on account of being a long distance from the collieries, high railway charges, and poor sale for residual products. All these, together with a number of (fortuitous or otherwise) factors, make it impossible to accurately state at what price gas can be sold in a certain place, without being intimately acquainted with all the circumstances of the district, and having sufficient technical skill to estimate these factors at their proper value. Hence we find the charges for coal gas vary greatly in different districts; and I apprehend the same would apply if water gas were substituted for coal gas. I have, therefore, in my estimate giving the cost at which these gases can be distributed, eliminated all disturbing factors, so as to enable you to make a fair and equitable comparison.

I have given the various items in detail, as to the manner of arriving at the net cost of production; and from these figures we see that coal gas costs about 4d. for coals, less residuals, against about 5d. per 1000 cubic feet for water gas. The total expenses for coal gas are 1s. 9d., against 2s. 6d. per 1000 cubic feet for carburetted water gas, or nearly 43 per cent. cheaper. Again, if we compare uncarburetted water gas, we find the cost is 1s. 5d., as against 1s. 9d. per 1000 cubic feet for ordinary 17-candle gas; but as twice the quantity of water gas must be used, whether for lighting, heating, or motive power, the actual cost to the consumer would be 2s. 10d. per 1000 cubic feet.

Suitability of Water Gas for Distribution.—It is a well-

known fact that carbonic oxide is a deadly poison, and to distribute a gas containing about 40 per cent. of this dangerous compound would be unwise in the extreme; for, from information to hand, I find that, taking a period of seven years, 177 persons in the State of New York were poisoned through inhaling water gas which had escaped into the air they breathed, and this compared with 9 cases during the same period from the effects of coal gas. From experiments made in Switzerland, with an apparatus specially contrived to contain water and producer gases and air in various proportions, it was found that a fatally poisonous mixture is an atmosphere containing only 1 per cent. of water gas and 1·5 per cent. in the case of producer gases. These gases are devoid of smell; and unless they are mixed with some pungent vapour, so that an escape can be detected at once, lamentable accidents are sure to attend the introduction of these gases. Now, in America they have had some experience with this water gas, over which speculators have caused so much excitement in the financial world and in Stock Exchange transactions; the result being that in the States of Massachusetts and New Jersey they have passed laws forbidding the sale of gas containing over 10 per cent. of carbonic oxide, though the water-gas people have used every effort, and spent thousands of dollars, to endeavour to have these laws repealed. The claim that water gas is superior to coal gas is delusive; for, if supplied carburetted (which is the only practical method of distributing it as a gas for illuminating purposes), it is found almost impossible to maintain it at a uniform candle power.

When giving this subject no small amount of attention some two years ago, I entered upon it with a sanguine expectation. But the more information I obtained on the question, the less favourable did it appear; and I can now conceive of no commercial undertaking that has less chance of success, as now proposed, than the manufacture and distribution of water gas in competition with coal gas in England.

OHIO GASLIGHT ASSOCIATION.

We conclude to-day our abstract report (taken from the "Official Report" in the *American Gaslight Journal*) of the proceedings at the recent annual meeting of this Association.

A paper on the subject of "Gas Monopoly" was read by Mr. W. W. Cantine, of Alliance, Ohio. After noticing some interesting facts in connection with the history of monopolies—a word that means in a legal sense the granting of rights of exclusive sale by the Crown or by Parliament—he proceeded to refer to the practice of municipal authorities in acquiring gas-works, which was a similar thing to the acquirement of railways or telegraph systems by the government. Anything in the way of trading that might be carried out by private enterprise, undertaken either by local or national governments, was condemned as contrary to English and American ideas, and an approach to the theory of the government in Russia, China, or Ancient Rome. One of the most potent reasons why gas should be a monopoly was because the invested capital was permanently located. However badly the investment might turn out, the business could not be moved to a more favourable locality, as might be done in almost every other case. Referring to the history of the formation of gas undertakings in America, he explained how it was that as a rule they usually drifted into the hands of a very few persons, who were abused as "monopolists." When the company was first started, subscribers were freely forthcoming; but the first few years' working, with small consumption, was usually a time of struggle and perhaps no dividend. Then it was that many of the original shareholders backed out. Sometimes barely sufficient members remained to form a board of directors. When the difficulties had been overcome and the concern was an established success, this small body, bound together by ties of self-interest, naturally kept all the stock in their own hands, held their meetings in the president's parlour, kept the accounts strictly private, and divided large profits. In many cases too much conservatism had prevailed in regard to new improvements in connection with manufacture, purification, &c. The directors, feeling well intrenched, had been satisfied to let well alone. Competition, if not altogether acceptable, may have its uses in leading to more enterprise. All the lighting of a city or town would in due course of time be done under one management. Electric light companies were not a financial success when run in competition with gas companies; nor were the public so well served as they would be under one management. In concluding, he quoted from a work on "The Economic Value of Electric Light and Power," by Mr. A. R. Foote, a powerful paragraph against local authorities entering upon anything that could be done by private enterprise, including the supply of gas or electric light.

Mr. H. Wilkiemeyer, of Portsmouth, Ohio, followed with a paper on "Methods of Taxation of Different Gas Companies." The first question was: What portions of the plant and property of a gas company are to be considered as real estate, and what as personalty? On this point not only did the law vary in different States, but it was differently interpreted and applied in various localities in the same State. The general view was that all things connected with, and necessary to, the use of the plant could properly be classified as realty. Personal property also became a part of the real estate when connected to it as a necessary accessory. Thus main pipes, before being fixed, were personal property; but afterwards they became a necessity to the proper use of the manufacturing plant, and therefore a part of the estate. It was the usual practice in Ohio to include not only the manufacturing but also the distributing plant in the real estate; but money or goods on hand were, of course, regarded as personal. In some States—for instance, in Tennessee—no distinction between real and personal estate was made, but the whole possessions were taxed. In Pennsylvania and other States, the owner made no return, but a law officer valued the property according to his own idea; the owner being allowed a right of appeal against such valuation. Even in Ohio there was a tendency to "lump" the whole of the property as real estate. In many States, especially the older ones, the capital stock was taken as a basis for the calculation. The grounds, buildings, fixtures, &c., were assessed by officers appointed for that purpose, as real estate, every one, two, five, or ten years, as the case might be. This valuation was subtracted from the capital stock taken at par value; and the remainder was taxed as personalty. The chief advantage of this plan was the frequent valuations. But taking the par value of the capital stock was an advantage to prosperous undertakings, of which the actual value might be 200 per cent. or more, and disastrous to new or weak undertakings where the actual value had fallen far below par. It aided powerful corporations to accumulate wealth, and crushed out their weak rivals. Where the mains were taxed as realty, their depreciation could not be taken into account; but where they were returned as personalty, it was a general practice to deduct an average of 3 per cent. per annum from their cost, as depreciation. There were no fixed rules as to depreciation or wear and tear in any State. In very few were there any fixed laws as to the return of personal property as to value. In some the assessor was the judge, subject to appeal; and in others the owner was the appraiser. In many States the meters were regarded as personalty; and, as such, an allowance for depreciation was made each year. The grounds and buildings only were regarded as realty in some States—the manufacturing, purifying, storing, and distributing apparatus being classed as personalty; and in such cases it was the custom to deduct about 5 per cent. annually for depreciation. In this, where the whole plant was considered realty, and the valuation made once in 10 years, they could have no advantage on account of depreciation in value except at these periods; and then the matter depended largely on the liberality of the appraisers.

In the course of the discussion that followed, Mr. Thomas remarked that in New York assessors were appointed, and the gas companies made no returns. These officers decided what was real estate and what was personal property; and they were interested in making the former as low as possible, because the rule was to assess real estate at 70 per cent., whereas the personal property was put at full value. It was also the practice in New York to consider the actual, and not the nominal value of the capital stock. Mr. Cantine said he had heard on good authority that all pipes and mains outside the works were exempt from taxation; and that a decision had been given to that effect in the State Supreme Court. Mr. Wilkiemeyer, in replying, thought Mr. Cantine was mistaken, and that the question had never come up in any Court. It was decided to refer the whole question to the Legislative Committee of the Association, with instructions to investigate and report at the next meeting.

A paper on "Fuel Gas and Incandescent Gas Lighting" was read by Mr. E. Lindsley, of Cleveland, Ohio. In commencing, he drew attention to the general demand for a fuel gas that should be cheap, not necessarily as regards volume, but in respect to the production of heat units. It should be safe, for which purposes the specific gravity should be materially less than air; and the odour should be permanent and unmistakable. Neither friction nor exposure to cold should entail condensation, no matter how extended the lines of distribution. Referring to comparisons between gaseous and solid fuels, as hitherto published, he thought the former were placed at a great disadvantage, by being used in appliances not so well adapted to their purpose, as those for solid fuel. Quoting from various sources, he showed that 15,000 to 21,000 cubic feet of natural gas were equal in practical value to 2000 lbs. of coal, costing 15s. or 16s. According to some estimates given by Mr. M'Millin, in a paper read before the American Gaslight Association in 1887, it appeared that the relative value of various gases, as compared with natural gas = 1, was as follows:—Coal gas, 1·5; water gas, 3·42; producer gas, 7·7. Therefore 22,500 cubic feet of coal gas, 51,300 cubic feet of water gas, or 115,500 cubic feet of producer gas would be required to equal the quantity of coal above named; and the relative values would be: Natural gas, 11·6d. per 1000 cubic feet; coal gas, 7·7d.; water gas, 3·4d.; and producer gas, 1·5d. per 1000 cubic feet. At these prices they would be equal in cost to coal. In his opinion one direction in which to look for cheap fuel gas was the complete gasification of the coal. A retort might be charged with small charges every hour, and the resulting coke passed on by machinery, without exposure to the atmosphere, into a chamber where it could be converted into water gas by means of superheated steam. Both illuminating and fuel gas would thus be obtained. The paper concluded with a few remarks on incandescent burners.

Before proceeding to discuss this paper, another of a similar kind was read. It was entitled "Carburetted Water Gas and its Advantages over Coal Gas," and the author was Mr. C. R. Faber, of Toledo, Ohio. He said that formerly it would be considered little short of treasonable for a coal-gas man to speak in favour of the subject of his paper; but to show the recent change in this opinion, he quoted in full the leading editorial from the Journal of Oct. 16 last, which dealt with the remarks made by Mr. H. E. Jones on the use of water gas in America, at the meeting

of the Commercial Gas Company. From this he gathered that the coal-gas people of England would engage in the manufacture of carburetted water gas, perhaps at first as an auxiliary only, if conditions were favourable. The great advantage possessed by water gas was that the plant required was not extensive or costly, and that it readily admitted of a very wide variation in the daily production of gas. In coal-gas manufacture some one had to do very hard work, and careful attention was requisite to secure uniformly good results; but water gas did not involve any hard work; and uniformly good results were easily obtained by the exercise of reasonable care and intelligence. The extra labourers about a coal-gas works would suffice for the entire running of a water-gas works of equal productive power. He also maintained that the quality of the carburetted water gas was better than that of coal gas. Formerly 12-candle power was considered sufficient; but now 16 candles was the usual quality from ordinary coal. But water gas rendered a still higher quality an easy possibility. Cannel coal and oil gas had both been applied for increasing the quality of gas from ordinary coal; but in each case there were drawbacks. The illuminating power was certainly increased by the use of cannel or crude oils; but the flame was thick, heavy, orange coloured, and not so satisfactory to the consumers, as when petroleum naphthas were used as the enriching materials. The cannel hydrocarbons were heavy; but those from naphtha were light, and therefore yielded a thinner and whiter flame. One of the difficulties incidental to the use of naphtha, was the necessity for using a fractionated product made up of hydrocarbons having a narrow range of densities, so as to ensure the complete gasification of the whole. The crude petroleum would yield soot from the light parts, tar from the heavy ones, and gas from only the heart of the oil, which would prove both annoying and costly. When using naphtha as an enricher, it should be converted into gas, and not simply vaporized. Coal gas would not carry naphtha vapours without risk of smoking when burnt, besides the liability to condensation, in which case the gas would be poorer than if no enricher had been used, as the naphtha would also carry down with it some of the light-yielding hydrocarbons. So he claimed for water gas, that a higher quality gas could be distributed with less risk of imperfect combustion; and that any crude petroleum could be used as the enriching material. Without entering into the question of relative cost, he would remark that the consumption of material per 1000 cubic feet of 20-candle water gas delivered into the holder, would be about 45 lbs. of coke and 5 gallons of crude oil.

Discussion being invited, Mr. Somerville inquired if Mr. Faber had found that water gas carried as well as coal gas. In his experience, beginning at, say, a quarter of a mile from the works, it deteriorated much faster than coal gas, especially in cold weather. He would also like to know if the water gas went through the same process and apparatus as that previously used for coal gas. Many persons made the mistake of passing water gas direct from the superheater, where it was exposed to a very high temperature, to the condensers, thus subjecting it to a very rapid cooling. He considered this to be a mistake, and was certain that if the cooling was more gradual the results would be better. Soft coke was preferable in his experience to hard coke for making water gas. Mr. Starr asked if Mr. Faber had any trouble with naphthalene, or from meters leaking. Mr. Monks thought that ultimately all the large gas-works in the country would be supplied with plant so that they could manufacture coal or water gas according to circumstances. But the experience of the South Boston Gas Company had shown that a great deal of dissatisfaction arose if consumers were supplied indiscriminately with coal or water gas, one to-day and the other to-morrow. So at works where both processes were carried on it was better to well mix the gas in a holder before distribution. Mr. Evans, in reply to a question, said that the United Gas Improvement Company supplied apparatus on the Springer principle, which only differed from the Lowe or the Granger in respect to some little points of construction. The superheater was essentially the same in all. Mr. Faber in replying said that he found the water gas to be thoroughly permanent, and to distribute as well as coal gas. The apparatus he used was known as Humphrey's arrangement of a combined Lowe and Granger, and it made a very moderate percentage only of carbonic acid. The water gas was charged with oil vapour in the second cylinder, and the vapour was converted into permanent gas by passing through the superheater, which was of sufficient size to allow the mixture to pass at a moderate speed. The condensation in the purifying apparatus, &c., was not so much as that from coal gas. At his works the water gas was stored in a relief holder, from which it was admitted to the coal-gas plant at a point near the exhauster. The two gases passed on together through the scrubbing and purifying apparatus and were thoroughly mixed. He believed the object of the short connection, complained of by Mr. Somerville, between the superheater and condenser, was to secure facility in removing deposits of lampblack. A longer connection might get blocked. In his case, the gas passed through a scrubber first, where all tar and soot was removed, and then on to the condensers. He could use either hard or soft coke, but thought the shallow generator, as operated on the Granger type, would scarcely permit the use of soft coke. In his apparatus there was a depth of 5 to 6 feet of coke in the generator.

Mr. G. H. Taylor, of Warren, Ohio, gave an account of a holder, tank, and house that he had lately erected, in which certain signs of weakness had appeared. In the discussion that followed, some suggestions as to the cause of the defects were offered.

Mr. G. W. Graeff, Jun., of Philadelphia, next of all described the latest form of the Welsbach incandescent burner, showing how the various difficulties in connection with this system of lighting had been met. He illustrated his remarks with specimens; and claimed that the burner had been proved a practical success.

Mr. Strong, of Mansfield, followed with a short paper on "The Results of the Adoption of Electric Lighting by a Gas Company," from which it appeared that he had applied the arc electric light for public lighting, with satisfactory results, financial and otherwise. A long discussion followed, in the course of which Mr. Somerville asked whether any of those gentlemen who supplied electric lights, were under any obligation as to illuminating power, similar to those demanded from gas companies. Mr. Cantine added, that if any such regulations were in vogue in regard to incandescent electric lights, he would be glad to know how the rapid deterioration of the power of lamps on this system was dealt with. Two or three speakers having expressed opinions in favour of a combination of gas and electric interests, Mr. Faber contended that the tendency of the present day was to specialize. This was the rule in science, philosophy, medicine, &c., and therefore he thought that communities would be best served by the specializing of each particular interest. Mr. Somerville said that in his city they preferred to stick to their own business, doubting whether it was a good thing to take up the entire electric lighting; and others concurred in this opinion. Mr. Starr said that in his experience the incandescent electric light proved 20 per cent. more expensive than gas at 5s. 3d. per 1000 cubic feet.

At this point the suggestion as to the change of title of the Association was brought up. Mr. Coverdale spoke strongly against such a change, urging that it would admit a lot of people into the Association who were interested in electric lighting, but not in gas. Electricity was exciting a great deal of attention, and the result would be that all the time of the meetings would be occupied by electrical subjects. After some discussion, it was decided that the matter should be postponed indefinitely.

Mr. C. Evans, of Jackson, Mich., then read a paper on "The Results of Experience in the Manufacture, Distribution, and Use of Fuel Gas." In November, 1883, non-carburetted water gas was introduced into the town of Lynn, Mass.; and as it was well advertised, a large number of consumers took it up. But difficulties soon arose. The gas proved far short of the theoretical heating value claimed for it, and bad odours from the products of combustion escaped into the rooms. For as the gas was all to be used under chimneys, it was not thought necessary to purify it. The impurities in the gas rapidly corroded stove-pipes, &c., and injured gas-engines. So he was most emphatic in denouncing the distribution of unpurified gas. Eventually the gas was purified; but even then, when sold at 2s. 1d. per 1000 cubic feet, it could not compete with coal. At Jackson the fuel gas had been successfully introduced; and his output was half a million cubic feet per day, the price being 1s. 6d. per 1000 cubic feet. The gas was prepared from bituminous coal slack which was first of all carbonized in the retorts in the usual manner; and the resulting coke was drawn direct into the generators. The retorts were heated by crude oil, for which purpose 23 gallons per ton of coal was sufficient, and the cost was 5s. 8d. per gallon. The waste heat was utilized for generating steam; and the average yield per ton of coal was 96 lbs. of tar and 36,000 cubic feet of mixed coal and water gas. The gas was purified by oxide of iron in the usual way; and its composition was: Hydrogen, 52·39 per cent., carbonic oxide, 36·31 per cent., marsh gas, 8·51 per cent., with small proportions of olefiant gas, carbonic acid, nitrogen, and oxygen. The theoretical heating value was 402 units per cubic foot. Gas of this quality at 1s. 6d. per 1000 cubic feet was cheaper than anthracite coal at 25s. per ton for use on the small scale. He was using the Fahnejelm incandescent burner with this gas as a source of light, and with great success.

In the discussion which followed, Mr. Printz asked how often the combs on the Fahnejelm burners required renewal, and the cost per 1000 cubic feet of gas used. Mr. Somerville inquired how the heating value of the gas was arrived at, and also the usual family consumption per month. Mr. Evans, replying to these and other questions, said that the combs required renewal every 100 hours. They cost 1½d. each, so that represented a cost of 3½d. per 1000 cubic feet of gas. He estimated the heating power by raising a known weight of water a certain number of degrees. The usual consumption amongst families was 6000 cubic feet per month for cooking only, or three or four times as much if heating was also included. The net rate was 1s. 6d. per 1000 cubic feet, from which no deductions were allowed. The supply pressure was about 2·7 inches at the works, and meters rather larger than for coal gas were required, because the specific gravity of the fuel gas was higher—about ·532. He believed that in future the gas would be distributed under higher pressure, and a governor provided on each service. He had steel mains with screw joints, 11 miles in length, laid 5 feet deep; and his loss by leakage was less than 1½ per cent. The cost of the gas in the holders was under 5d. per 1000 cubic feet, and there was absolutely no condensation from it. The entire plant of his Company cost less than £30,000.

The last paper was entitled "Crude Oil as a Fuel under Boilers," and the author was Mr. J. W. Gwynne, of Bucyrus. Theoretically 126 gallons of oil should exceed a ton of coal in heating value; but in practice the result was not so favourable to the oil, as in the course of prolonged experiments it was found that 251 barrels of oil were required to do the work of 65½ tons of coal. Therefore it appeared that wherever four barrels of oil could be bought for less

than a ton of coal, the oil was cheaper. He used a boiler 16 feet long, with 42 tubes of 4 inches diameter. The oil was injected by steam, and the air supply was heated before admission to the furnace to not less than 400°, by being caused to pass through a channel of fire-bricks built in the ash-pit. In concluding, he remarked that experiments were now being made in the way of solidifying oil, which was done by adding 1 to 3 per cent. of soap. The result was a compact solid like tallow, which burned slowly and developed great heat.

VENTILATION BY GAS.

By J. F. Simmance.

[A Paper read at the Royal Institution, Liverpool.]

(*Concluded from p.* 953.)

The second part of our fourth point is the air required by the gaslights, and which alters according to the type of light. In the cluster of flat flames I have here, no artificial means are used to create a draught. In the compound Argand, arrangements are made to supply air at the base of each ring of flame, and a separate intake of air between the glass and copper chimneys aliments the tips of the flames. I should say that with 16-candle gas this Argand gives 33 per cent. more light than the flat flames; it having been constructed by Mr. William Sugg (the inventor of both systems) for that quality of gas. He has now perfected an arrangement of elongating the air chambers of the burner so that with Liverpool gas it should as far surpass the flat flames in duty as it does in London with the poorer gas.

With this "Cromartie" lamp the currents of air impinging on both sides of the flame do so at right angles to its surface, and in obedience to the induced draught of the eduction-tube, spread along the flame in most intimate connection. By this arrangement a large quantity of air is drawn through the lamp. But as the air supply varies so considerably, being affected by the size and type of lamp, the quality of gas, &c., in order to avoid complication in our calculation, I have decided to take 20 cubic feet of air per cubic foot of gas burnt as a maximum quantity which will meet the demands of either of the systems discussed.

The reason for requiring the temperature of the exhalations of the persons present and the gas combustion is, of course, to enable us to calculate the expansion; for it is certain that a cubic foot of air coming into the room is in a very different condition when it goes up the ventilating shaft. But the breath from the lungs will be diluted to such an extent by the surrounding atmosphere (which we may take roughly to be 65° Fahr.) that its 98° will be reduced to 70° within 18 inches of the lips, which makes the question not worth considering. But the heat of the gas is a more important matter; for it is by means of this heat that the products, shooting up the inner tube, diffuse themselves all over the outer tube area within a foot or so of the end of the inner tube, and obviously draw in large quantities of the atmosphere which jackets the inner tube. In fact, the inner tube acts like a steam-jet ventilator or water-spray, and in addition superheats this jacket of steam and vitiated atmosphere, and so accelerates its passage up the shaft.

It appears reasonable that the "Cromartie" lamp should not be so hot at the outlet as the others. So much of the heat of its gas combustion is transformed into radiant heat on account of the extent of absorbent and radiating surfaces with which the products of combustion are in contact, that (comparatively) very little is left in them. The Argand would appear to be as hot as any; the entire heat being gathered in a small compass, and projected upon a small space, comparatively uncooled by the surrounding atmosphere, which immediately lowers the temperature of the more accessible products of the flat flames. Judging the heat at a sufficiently great distance to admit of any possible dilution and cooling to take place, at the exit of the inner tube only we find that to estimate 750° as the heat of the gas combustion at a maximum will give us the means of calculating our point of the temperature at the base of the eduction tube. You must not forget that this is the inner tube only; the aggregate of the inner and outer, when complete diffusion or dilution takes place, is much lower. The estimate of 750° is too high for the "Cromartie;" but I do not think that, taking all points into consideration, we shall do harm by calculating all the lights alike.

So far we have been seeking data to enable us to compute the volume of air we require to find its exit hourly. We now answer questions Nos. 6, 7, and 8. The height of the vertical shaft must, in a great measure, depend upon the architectural necessities of the building, and may be looked upon as arbitrary. If you cannot get height, get area; if you cannot get area, get *heat*. By the way, do not infer from this that, not getting area or heat, *height* will do. The temperature of the diluted products of combustion at the base of the upcast shaft is as nearly as possible 400°. The temperature of the external atmosphere is the mean between (say) 30° and 90°, or 60°—a good average.

Having now gathered together all our data, we can formulate them; but before doing so, we must look for a moment at the principle upon which we are working. The expanded air is forced up towards that stratum of the atmosphere where the rarefaction is equal to its own. Should it not lose its heat, and yet be protected against diffusion by confinement in a shaft, it should rise until an equilibrium is restored. But with our subject we find the hot products get cold by the absorption of heat and re-radiation by the flue material itself. We can keep the products together by a flue, and so make more use of their ascending power by preventing diffusion; but the loss of heat is completely damaging to any great confinement in the flue, and consequently to any minute detail in the calculations concerning it. We know the rules of falling bodies; but they do not apply at all to this, though they would do so if it were not for this loss of heat. There is a known variance between the specific gravity of the heated products and the cooler atmosphere; but its preservation depends to a large extent upon the material and position of the flue. A comparison, though not a good one, is that of a cork deep down in the sea. It preserves its own specific gravity amidst the enormous pressure of water, and when released from that great depth bounds upwards. But its relation to the specific gravity of the sea alters as it gets near the surface; in fact, the water gets lighter, so to speak. Perhaps a better comparison would be a balloon of hydrogen, with a hole in the crown allowing a constant escape of the inflating gas, released from the earth. I am aware my comparisons are not good, but there really is a difficulty in finding a parallel with the products of combustion whose increase of weight is so variable, and is acted upon by so many causes—material of flues, outside weather, barometer, &c., &c.

But we can perhaps do better. We may take the results of varying experiments, and accept a formula that will cover all these results; so that if you propose to use an iron, brick, earthenware, or zinc flue on a roof or under floors, in a wall or on its outside face, your ventilation will come out right.

Let C = Candle power required.
D = Distance from farthest wall to position of light
I = Illuminating power of light required.
d = Duty per foot of gas.
A = Air per foot of gas.
a = Air per person.
N = Number of persons.
v = Volume uncorrected.
T = Temperature (Fahr.) at base of tube.
V = Volume corrected.
H = Height of tubes in feet.

$$CD^2 = I. \quad \left(\frac{I}{d}\right) A + aN = v.$$

$$\left(\frac{v}{480}\right) \underline{T - 60} + v = V \qquad \sqrt{H\,(T - 50)\,720} =$$

the quantity discharged under these conditions through a tube 1 foot in area per hour. As this quantity is to the quantity required to educt V, so is the necessary area of tube to 1 foot (144 square inches).

I will now take as an example a small room 40 feet square by 25 feet high, and seating 400 people. Supposing we propose to use one light, we require the distance from the centre of the ceiling to the wall at the floor line. The height being 25 feet, we get a triangle of 25 feet perpendicular and 25 feet base, with a hypotheneuse of 32 feet. The square of the hypotheneuse multiplied by the desired power of light upon the wall (say, 0·25 of a candle) gives us 256 candles, which is not enough if the room is decorated with absorbing colours. Dividing candle power by duty per foot of gas (say 8), gives us 32 feet per hour. Then 400 people require 8000 cubic feet of air per hour; the gas requires 640 cubic feet, which expanded (after adding the 32 feet of gas) to 400°=14,552 cubic feet per hour for which we desire inlet and outlet. As I have said, we can get inlet in excess; our point is outlet. Multiply the square root of the height (in feet) of the shaft you can command, multiplied by the diluted temperature at the base of the shaft (400°), less the outside temperature, by 720. We will say the construction of our ceiling allows of a 5-feet vertical shaft, we thus get a passage of 29,520 cubic feet should the shaft be 12 inches in diameter. This would change the entire air of the room in about an hour and a half; the air issuing at the rate of about six miles an hour. We do not require so large an outlet; in fact, the less we can do with, the less likelihood of draught, apart from the question of cost. So, as the 14,552 cubic feet we want is to the 29,520 cubic feet, so is our required area to 1 foot square. Then a 9-inch diameter round flue would fulfil all our requirements. As a matter of fact, lights to illuminate such a room are constructed, as a rule, by the best firms, with 9-inch shafts. With such an arrangement ventilation is certain, provided the most elementary philosophical laws are complied with; it can be produced in a moment by turning on the gas-cock; the ceilings are kept free from all discolorations by the combustion products; and the general effect in light is superior.

I now pass on to a few points of interest which may, I think, forestall some queries from you.

Down-Draught.—This should never be a difficulty when the building is not surrounded by higher buildings, and has no direct communication with any larger apartment or building; neither, obviously, should it have a large fire going in the same room as the ventilating light, unless the proper inlets for air are allowed. I have, I think, shown that our ventilation is derived from heat at the bottom of vertical shafts; so a fire and a ventilating lamp in the same room must be considered in the light of our formulæ. If the light gives the greatest velocity to the air, the fire must suffer; if the fire is the hottest, the light will not work. But give the fire enough air by inlets to supply the chimney, and give the light enough air for its shaft, and both will work well. At a club smoke-room near here there is an old-fashioned sun-burner with a shaft having an outlet on the roof. The fireplace of the room holds a fairly good fire, as a rule, and insufficient inlets are provided, so the fire gets most of its air from the sun-light—all the combustion products being drawn straight down, mixed with outside air, to the fire. Now, in summer, when no fire is going, and the room is actually cooler than the sun baked chimneys, I have no doubt that the sunlight will ventilate—drawing its air from the chimney by reason of the superior velocity of the gas-heated products.

Then, to secure a constant upward current, it must not be forgotten that the heat in the chimney must be sufficient to expand in some degree the whole column of air. If the tube is in an exposed condition, and is made (say) of sheet iron, its length is not doing much good unless the tube is warm for the whole of its length. If you were to make two flues of equal length and area, standing side by side, one in a brick setting and one in a sheet-iron tube, both communicating with a closed chamber in which a fire was burning, the one with the least radiation would be the upcast, and the other the intake.

Going back to my question of fires and ventilating lights, if only enough air can be obtained to supply the fire, the flue of the light may run into the chimney-breast; but then you must diminish the register space of the fire in order to leave some air for the light.

In the event of the room to be lighted and ventilated being (say) at the bottom of a well formed between high buildings, you have two courses open—either to carry a flue to the top, and use a very hot light; or to carry the flue into a neighbouring chimney running right up, in which case you must operate upon the register of the fire at the base of the chimney, as I have said.

One apparent objection to ventilation by gas is that in the day time the gas is not burning, and then ventilation is stopped. But do not stop it. Have a single burner going, or, if it is a crowded meeting, light up the whole. Gas is cheap. The lighting of a room seating 400 people, as I have before mentioned, only costs a penny; and surely it is better to pay a single penny per hour than to be imbibing, for the term of the meeting, all your neighbours idiosyncrasies into your own constitution. This apparent objection is not a valid one. You may say, too, that it is not always one has to deal with a room from which a vertical shaft is practicable, and horizontal flues must be used. This is frequently so, but the remedy is obvious. Place a well-protected vertical shaft outside, and connect your horizontal flue, which should, of course, be of some non-conducting material. The point is to get the base of the vertical tube hot. Such an arrangement will ventilate just as well as a vertical one, only you will require more heat to keep the extra length of pipe warm. That is where the utility of different kinds of lights comes in; you can choose the one that will suit your convenience.

Danger of Fire.—Non-conducting pipes should be used for all flues; and if the junctions are properly luted, no danger need be apprehended. A gaslight will, at close quarters, heat a sheet of iron red hot; but there are many known kinds of pipe which I have never found capable of being heated to that extent. The objections sometimes raised by insurance companies to ventilating lights have been elicited by slovenly arrangements and cheap scamped work. But a good system of non-conducting pipes carries its recommendation on its face; and the best-known companies have approved of installations of ventilating gas-lights so arranged.

In conclusion, ventilation by gas has only comparatively recently been deemed at all worthy of architects' attention. But sanitary matters are now looked upon as important; and we are all beginning to see that, although cholera and typhoid can scarcely be put down to unventilated places of assembly, yet diphtheritic and other germs as infectious and deadly, and occupying just as prominent places in our bills of mortality, may fairly be put down to that. So that, although with good ventilation by gas you may not be supplied with air as pure as that on Snowdon, yet you may reasonably be confident that in a room so ventilated you are at least respiring the very best and purest air the neighbourhood can afford.

Copies of the accounts of the Metropolitan Gas Companies for the year 1888 were presented to both Houses of Parliament last week, in compliance with statutory requirements.

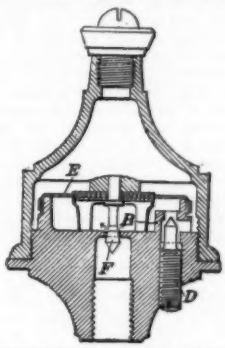
At the meeting of the Institution of Civil Engineers last Tuesday (the final meeting of the session), Sir Henry Bessemer, F.R.S., and Sir William Thomson, F.R.SS. L. and E., LL.D., were elected honorary members.

During the past few weeks Mr. H. Graham Harris, M. Inst. C.E., has been delivering, at the Society of Arts, a course of Cantor lectures on "Heat-Engines other than Steam;" and on Monday last week he described the various kinds of motors which are driven by gas. He explained, with much minuteness, by the aid of large working models, the mode of operation of these engines; and, with regard to the well-known types now in the market, he said they all possessed special advantages of their own. He pointed to the loss of heat through the cylinder jacket as a defect in gas-engines, and stated that the reduction of this loss was usefully engaging attention. He referred to the double-cylinder engine which has been designed by Messrs. Crossley with the object of diminishing the loss arising from the high temperature of the exhaust gases, and expressed the opinion that the simple gas-engine might be improved in this direction as the simple steam-engine had been. After making allusion to Sir W. Siemens's regenerative gas-engine, Mr. Harris remarked that the class of motors he had been describing were fast displacing steam-engines for small powers; and he confessed that he could not see why they should not do so for large powers. Possibly the reason they had not done so was to be found in the fact that the makers of these engines were too busily employed on the manufacture of the small ones to allow of their turning their attention just now to the production of others of much greater working capacity.

Register of Patents.

Gas-Governors.—Sugg, W. T., of Westminster. No. 8640; June 12, 1888. [8d.]

This invention relates to diaphragm regulators or governors in which the gas pressure is on both sides of the diaphragm; and the invention will be understood by referring to the accompanying sectional elevation of a "Christiana" burner with the invention applied thereto



The body of the governor is cast with a hollow cylindrical portion at its upper end, as usual, to form the gas chamber; and on one side of this cylinder there is a lump or block B. From the outside of the body and upwards through this lump, a hole is bored, the lower portion of which is threaded to receive a screw-plug D. The upper end of the plug is coned to form a valve, which will close the passage from the gas chamber to the hole. At right angles to the hole, and through the wall of the cylinder, a second hole is bored to meet the vertical hole; thus forming a passage from the inside to the outside of the cylinder. The size of the passage is enlarged or contracted by a screw plug-valve, for the purpose described in patent No. 4146 of 1886. The top of the cylinder is covered by a flexible diaphragm E in the usual way. This diaphragm is formed of one or more thicknesses of "baudrouche," which consists of the skin of a fish, in combination with leather; the two being joined together by india-rubber solution. Or sarsenet or fine silk is employed, prepared by treating it with a mixture of glucose sugar, glycerine, and Marseilles soap. This last-named preparation, says the patentee, is extremely suitable in hot countries, as it is little affected by any heat to which it may be reasonably exposed. Diaphragms prepared by either of the above modes are unaffected by the ammonia.

Secured to the diaphragm in the usual way, is a valve F, made of a long taper form, and with a conical base, so as to present as small a surface as possible to the action of the incoming gas. The diaphragm and cylinder are enclosed by a cap G, into which the burner tip H is inserted. The diaphragm E must be loaded, as usual, to ensure the opening of the valve should the pressure of the gas not exceed a certain limit.

Gas-Engines.—Roots, J., of Westbourne Park, W. No. 9310; June 26, 1888. [8d.]

The object aimed at in this engine is the maintaining of a high pressure through a great portion of the stroke, and the effecting of this in such a manner as to economize the gas.

The piston is made with the packing rings farther apart than usual. In casting the cylinder a port or aperture is made at a short distance from the end, over which aperture is bolted a casting forming a chamber open to the cylinder. The outstroke of the piston draws in a charge of gas and air, which is compressed by the instroke—a portion of it in the back of the cylinder behind the piston, and a portion in the chamber. The portion in the back of the cylinder is first ignited; the piston is impelled forward on its outstroke; and, on arriving at the opening to the chamber, the second compressed charge is fired, just when the crank is in a most favourable position for receiving an impulse. If the chamber is without communication with the back of the cylinder, the first charge is more compressed than the second.

Valve Apparatus for Gas-Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, Germany. No. 9602; July 2, 1888. [8d.]

This invention relates to apparatus by which the valve of a gas-engine may be opened when the maximum speed of the engine is exceeded; such mechanism having heretofore been supplied either to the ignition-slide or to the rod or lever actuating the igniting-slide.

According to the present invention, however, the inertia mechanism is applied to a construction of motor engine in which there is no ignition-slide; the engine cylinder being always in communication with an igniting-tube heated externally by a gas-flame, and the inlet-valve for gas and air being held closed by a spring. It thus opens automatically on the suction stroke of the engine piston; the ignition of the charge being effected when the highest degree of compression has been reached. In this construction of engine, the only valves that are mechanically actuated are the escape-valve for discharging the products of combustion after the working stroke, and the gas-valve. The escape-valve is held closed by a spring during the suction, compression, and working strokes; and it is opened by a sliding-rod acted upon by an automatic cam on the engine shaft such as that described in patent No. 17,108 of 1887, or by an ordinary cam on a countershaft driven at half the speed of the engine-shaft. This sliding-rod has an arm projecting from it, to the end of which is pivotted a pendant rod having a hook at its end which engages with a hook on the end of the stem of the gas-valve; so that, when the sliding-rod performs its upward stroke, allowing the escape-valve to close, it effects the opening of the gas-valve by the hooked rod. This rod has a weighted arm projecting horizontally from it, which has its end supported by a spring of such strength that, when the engine is working at the normal speed, it holds the arm of the rod in such a position as to cause the

rod to be engaged with the valve stem and open the valve; but when the rod moves upward at a quicker speed (in consequence of the maximum speed of the engine being exceeded), the inertia of the weighted arm in acting against the spring, will cause the hooked rod to be canted to one side, so as to miss the hook of the valve stem, in rising, and consequently the gas-valve will remain closed.

PRESSURE REGULATORS FOR GAS.—Parkinson, W. F., of Birmingham. No. 2974; March 7, 1889. [6d.]

This invention has reference to gas-pressure regulators in which the pressure of the gas is regulated by a conical or other stem or valve depending from a moveable float disc or diaphragm, and operating in or against the gas inlet orifice or orifices—such, for instance, as the regulator described in the patent No. 3639 of 1878, in which the float is provided with a conical stem or valve to operate in the inlet orifice. Heretofore, says the inventor, the base of the conical or other stem or valve has been exposed to the pressure of the unregulated gas, which (being variable) caused the float and the pressure of the gas at the outlet of the regulator to fluctuate; and it is this defect which it is the object of the present invention to overcome, by preventing the unregulated gas acting upon the base of the stem or valve and arranging for only regulated gas to have access to it. In this way any sudden inrush of gas or change of pressure is prevented from causing the float to fluctuate.

INCREASING THE LUMINOUSNESS OF IGNITED GAS.—Mactear, J., of Victoria Mansions, Westminster. No. 4124; March 8, 1889. [4d.]

This invention (which is not illustrated) is a development of the appliances described in patent No. 6811 of 1886; and is specially applicable to the Welsbach incandescent gas-lighting system. It has particular reference to the construction of the vehicle supporting the incandescence materials, upon the heating to incandescence of which the enhanced luminiferous effect is due—the "mantle, cap, or hood," as it is generally called. In the former patent there is described a method of constructing the mantle of any required form, by winding cotton fibre or other suitable fibrous material around a thin platinum wire, and then bending the latter into the form of mantle required. In accordance with the present improvements, the mantle is made (1) by braiding platinum wire with cotton or other suitable fibrous material, and subsequently bending the braided wire into the required form; (2) by covering or braiding platinum wire with cotton or other fibrous material, and weaving it into a fabric of the nature of wire gauze, or into a braid, and subsequently moulding or forming such fabric or braid into the required form of mantle; or (3) by weaving plain or covered or braided platinum wire with threads of cotton or other fibrous material into the required form of mantle, or into a fabric or braid, and subsequently moulding or otherwise forming such fabric or braid into the required form of mantle. By constructing the mantle according to one or other of these improvements, the incandescence materials are said to be better and more efficiently supported.

The mantle thus formed may then be rendered suitable for its intended purpose by being dipped into or otherwise impregnated or saturated with solutions of the incandescence materials hitherto proposed to be used for such purpose, or with such other means as may be suitable for the purpose; or the mantle during its manufacture may be impregnated or saturated with such materials; or the cotton or other fibrous material may be impregnated or saturated therewith before being braided on, or otherwise combined with the platinum wire, or formed into the mantle, as described, but not so advantageously.

APPLICATIONS FOR LETTERS PATENT.

7092.—BYROM, J., "Improvements in gas lighting." April 29.

7159.—HALLIGAN, J. F., "An improved apparatus for carburetting gas." April 30.

7233.—THORP, T., and MARSH, T. G., "An improvement in gas-meters." May 1.

7252.—LANGER, J. von, and COOPER, L., "Improvements in or connected with the manufacture of 'water,' 'Siemens,' 'producer,' or other such gases, and in apparatus connected therewith." May 1.

7569.—CROOK, G., "Improvements in gas-ovens for baking purposes." May 6.

7594.—CROWE, E. and H., "Improvements in gas and hydrocarbon motor engines." May 7.

7640.—LAWSON, S., "Improvements in gas-engines." May 7.

7641.—WALKER, W., "Improvements in the manufacture of gas and apparatus therefor." A communication from C. H. Seymour. May 7.

7653.—DUBOIS, C., "Obtaining useful products from refuse or residues of gas purifying and apparatus therefor." May 7.

7654.—DAVIES, P. J., "Improvements in sulphate of ammonia plant." May 7.

7659.—QUAGLIO, J., "Improved process and furnace for the preparation of calcin (crude glass) according to Leuffgen's method, by the combined use of water, coal gas, wood gas, oil gas, or natural gases and generator gas." May 7.

7665.—KRATKE, H., "Improvements in screw couplings for steam, gas, and water pipes, rods, and other objects subject to tortional strain." May 8.

7781.—HAY, A. M., "Improvements in the process and apparatus for producing oil-water gas." May 9.

7812.—ROSE, G., BAIRD, A., and BAIRD, M. B., "Improvements in the method of and apparatus for the manufacture of water gas." May 10.

7819.—GORDON, W., "Improvements in or connected with gas or vapour lamps." May 10.

7847.—BAXTER, R. S., "Improvements in the manufacture of water gas." May 10.

7854.—ARMSTRONG, G. P., "An improved apparatus for manufacturing carburetted air gas." A communication from G. Jaunez. May 10.

7889.—TAYLOR, J., "An improved gas-regulator." May 11.

8152.—RAWSON, J., "Improvements in reflectors for gas or other lights." May 16.

8163.—STERN, W., and MUCKE, J., "Improvements in regenerative gas-lamps." May 16.

Correspondence.

[*We are not responsible for the opinions expressed by Correspondents.*]

PHOTOMETRY.

SIR,—I have read with interest Mr. H. Leicester Greville's article on "Photometry" in your last issue. I agree with him that the rate of consumption ought to be increased if the gas is of poor quality, since the difference in quality is very marked when the gas is tested under varied rates of consumption. I see no reason, however, to alter the existing Instructions of the Gas Referees concerning the 5 feet per hour; for London coal gas is never 14 candles, or any way near it. The standard burner is adapted to consume gas of a quality equal to 16 candles; and since the quality varies but little from one year's end to another, I cannot foresee that much good could accrue from any alteration of rate. Besides, the variations above or below 16 candles are so slight that no examiner would trouble to make any alteration in this direction, in consequence of a difference of 0·1 candle.

I am of opinion that several of the late "penal cases" might have been avoided had the gas been burnt under more favourable conditions. There is little doubt one or two were due to a high barometer and especially a low temperature; the effect of such circumstances being to cause undue oxidation, which, although penalizing the gas, is no proof of inferiority.

Mr. Leicester Greville will find that the point "just short of smoking" in the chimney certified by the Referees is 4 inches from the stentite of the burner. He must know that the chimney measured from this point is really only 5¼ inches long, and even a 4-inch flame cannot be properly burnt in it. A 3¼-inch flame, however, can (and with advantage) be so burnt; but beyond this there is no economy. When gas is burnt in the standard Argand, it is practically impossible to accurately read the length of any flame, for the "peaks" are constantly on the move both above and below any fixed mark on the chimney. He says "there need be no extreme accuracy." Well, perhaps not; but what is the good of any new method unless accuracy be the object aimed at? In every case where a suitable and accurate standard is adopted, such as the "Methven two-candle," a far better method is to adjust the rate till you have light sufficient to obtain the reading "8 on the scaled bar." This reading need simply be multiplied by 2, and corrected for rate to the authorized standard.

South Lambeth, S.W., May 25, 1889. W. GRAFTON.

ON FLAME.

SIR,—In the discussion of the paper "On Flame" recently read at Glasgow, before the Scottish Section of the Society of Chemical Industry, I find that both Mr. W. Foulis and Mr. F. J. Rowan, the author of the paper, made reference to the method of heating furnaces by radiation, with free development of flame, which Mr. Siemens has introduced, and first described in a paper read before the Iron and Steel Institute in 1884. As Mr. Siemens's representative, I must ask you to allow me a little space, to make some remarks on the subject-matter of the discussion, as I was not present at the reading of the paper.

In substance, Mr. Rowan said that he was acquainted with Mr. Siemens's views, but did not think them well founded; that Mr. Siemens had recently given up the "radiation-only" view, and now described his method as "heating with free development of flame;" that the "heating-by-radiation-only" theory required, according to Mr. Siemens, the adoption of the so-called electrical theory of flame, in order to its being properly estimated; and, lastly, that the theory of luminosity of flame, referred to by Mr. Foulis, and described by Mr. Siemens, would not stand the test of severe criticism.

It is to be regretted that Mr. Rowan, before criticizing Mr. Siemens, did not inform himself as to what Mr. Siemens did say; for that Mr. Rowan has not made himself acquainted with Mr. Siemens's views is a fact clearly proved by reference to the report of Mr. Siemens's paper, and his remarks during its discussion, which appeared in Vol. II. of the *Journal of the Iron and Steel Institute* for 1884. At p. 442 of that volume, you will find that Mr. Siemens wrote: "The radiation period, with its active combustion of the highest possible intensity, is limited to the furnace chamber, which is made of ample dimensions, so as to allow the *flame free space to develop* without destruction to its chemical action by intervening objects." In the discussion of the paper (p. 478), Mr. Siemens said: "He had stated that in the first stage—that is, in that of chemical action—the flame ought to be allowed *free space* within which to burn; it should not be interfered with by surfaces of any kind; and it should be allowed *freely* to *radiate* out its radiant heat." This was Mr. Siemens's first paper on the subject published in England; and you will see he uses the expressions "heating by radiation" and "heating with free development of flame" as practically synonymous; so that Mr. Rowan's statement that Mr. Siemens has now abandoned "heating by radiation only" for "heating with free development of flame" is shown to be unfounded. But I must point out that Mr. Siemens's method of heating was never a "radiation-*only*" method; and he never so described it. He said in the same paper that, after the flame had given up heat by radiation, the products of combustion should be applied to heating, by conduction, the regenerators of a gas-furnace, or the sides of a boiler; and he described this new method of heating by radiation as applied to regenerative gas-furnaces—showing that, owing to the flame being undisturbed in its course through the heating chamber, its temperature would be higher, and, in consequence, the products of combustion would be much hotter than would otherwise be the case, and therefore much more effective for heating by contact the surfaces against which they were directed. I may add that heating by radiation is now being extensively applied in the regenerative gas-furnace, as the advantages which accrue from its application—viz., reduction in the wear and tear of the furnace, saving in material and fuel, and improvement in the quality of the material heated—are being more fully recognized.

Now, with reference to Mr. Rowan's statement that the "radiation-only" theory required the adoption of the so-called electrical theory of flame in order to its being properly estimated, I will again quote from Mr. Siemens. He said (p. 479): "It was agreed in all theories [of combustion] that the gases in combustion, forming the flame, were

evidently excited, and that the molecules of gas were rotating around one another, or were in motion of some kind. He thought the electrical theory had the best chance of being the right one," and he adopted it, in the instance referred to, because it enabled him to explain the evil effects of the disturbance of combustion in a concise and easy manner. From these remarks it will be seen that Mr. Siemens does not require the exclusive adoption of the electrical theory of flame to explain the advantages of heating by radiation; for it could be equally well explained by other physical reasoning.

As to the cause of flames being luminous, I think nothing can be clearer than Mr. Foulis's statement: "With regard to the luminosity of flame, he thought he might safely say that the theory held by all engaged in the manufacture of gas for illuminating purposes is that the luminosity is due to free carbon in the flame;" and his further remark that, "it was well known that the best photometric results were obtained when the flame was just on the point of smoking—that was, when the presence of carbon was at a maximum consistent with complete combustion"—is equally conclusive in this respect. On what principle can the well-known fact be explained that gas from cannel coal gives such high illuminating results, as compared, say, with ordinary London gas, except that there is more carbon in it to be rendered incandescent by the heat of the flame. In my paper on gas producers read before the Iron and Steel Institute in 1885,* I called attention to the advantage of using gas rich in hydrocarbons in furnaces heated by radiation, on the ground that they possessed high radiating power, which means high illuminating power.

JOHN HEAD.

11, *Queen Anne's Gate, S.W., May* 22, 1889.

GAS STOKERS AND THE EIGHT HOURS MOVEMENT.

SIR,—In the leading article on p. 942 of your last issue you state: "We knew that eight-hour shifts had been tried in different places, but had certainly received the impression that they had been abandoned. If there is any other gas manager besides Mr. Leather equally qualified to elucidate this point of carbonizing practice, we shall be very glad to hear from him." I also observe, on p. 953, that Mr. John P. Leather states that the eight-hour system has been in operation in Burnley, with very little intermission, for more than fifteen years. It may perhaps be interesting to you to be informed that the eight-hour system is now in operation in Liverpool, and that this method of working has certainly been in use here, without any intermission, during the last *forty-five* years; and I have every reason to believe that the practice commenced almost half-a-century ago.

WILLIAM KING.

Liverpool, May 24, 1889.

SIR,—With reference to your article on eight-hour shifts for gas stokers, I may say the system has been in practice at this station for the last 18 years; and it was adopted by the other two Gas Companies in this town at the same time. I have been in charge of this station for the last 14 years, and before coming here had experience of twelve-hour shifts in my former charges; but I think there cannot be a doubt that the eight-hour system is the best. You can command a better class of men; and with the arrangement of work the loss is not much, if any. The men on the eight-hour system are at work nearly all the time; they do not get the same rest as on the twelve-hour system. I could never advocate the return to the old system of twelve-hour shifts.

A. DOUGALL.

British Gaslight Company, Limited,
Hull, May 23, 1889.

SIR,—I see in your issue of May 14 an article bearing on gas manufacture and eight-hours work. You seem to be in doubt as to its practicability and its detriment to employer and employed; and you do not know of any gas-works in England where it has been successfully done. I see from your correspondent at Burnley, in your issue of May 21, that he has had 15 years' experience without any intermission; and I presume with beneficial results to all parties concerned. I may inform you that in Bristol it has been done for the last 12 years without intermission, and given the greatest satisfaction to all parties concerned. The men perform their duties more regularly than under the old system of 12 hours. With regard to the spare time, you presume the men would spend it with bad characters. I may say that having enjoyed the eight-hours system for 12 years, it has given me great opportunity for study and moral culture; and the effect upon the men generally is a great improvement upon their general surroundings. You also say that a twelve-hour shift has been never known to injure any healthy man. Sir, if ignorance is bliss, it is folly to be wise; proving once more the great difference between the worker and the looker-on. Even under the eight-hours system, the physical strain is so great that at the end we are quite exhausted, especially at this time of year.

A WORKMAN.

Bristol, May 25, 1889.

WATER GAS.

The following are extracts from further correspondence on this subject which has reached us:—

Replying to the letter by "Gas," which appeared in the JOURNAL for the 14th inst., Mr. B. H. Thwaite says: "What my letter [*ante*, p. 906] explained, I hope unambiguously, was that, owing to the high thermic value of the water gas, only half the thermal units are required to effect a given thermo-fusion work that is required when producer gas is used. The fact that Mr. Frederick Siemens's letter remained unanswered does not prove that the method of comparison was a fair one. I consider the comparison was incomplete; and therefore results deduced therefrom would be misleading. With water gas, the wear and tear of furnace and cost of maintenance would be less in proportion to the weight of output. The use of coke is not by any means a *sine quâ non* in the production of water gas. With gas generators of a special kind, any kind of slack coal can be made available. Although Bischof's invention was before its time, and had not the extended application of that of the modified form introduced by Messrs. Siemens, this fact should surely not preclude his claim to be considered the original inventor, and prevent him from having paid to him the scanty honour of the perpetuation of his name in honourable connection with a useful industrial agent."

Another correspondent, writing, on the 12th inst., under the *nom de plume* of "Steel Maker," observes: "I notice in the last letter of 'Gas,' that Mr. Siemens's letter of August last has not been contradicted. I must express my surprise that Mr. Siemens has not corrected his statement, or that some users of his process have not taken notice of it. The statement of cost is erroneous; for 1 ton of steel can be melted in the latest form of furnace with 7½ cwt. of inferior coal, obtainable, I am informed, at Swansea at 3s. per ton. Therefore, instead of Mr. Siemens's ton of steel costing 5s. 1½d., it should be 3s., for 7½ cwt. of coal at 3s. per ton=2s. 3d.; labour on gas producer per ton of coal=9d.—total 3s., as against 9s. 1½d. (according to Messrs. Wilson and Fox's figures for 1 ton melted by water gas)—as the 'producer' gas for other purposes should not be taken into account, being really a waste product. My own experience, which has been extensive both in this country and in the United States, is that water gas as a means of steel making can never compete commercially with producer gas, and for purposes where the large quantity of inferior producer gas (so called) cannot be used with advantage, water gas can never become general. At the same time, I do not dispute that for certain processes, such as welding, at the Leeds Forge Company's works it is of considerable value. Again, to make water gas a success for purposes where its high temperature is useful, a new material must be found for building furnaces; for with the new form of Siemens producer and radiating furnace . . . . . the greatest heat silica bricks will bear is easily obtained—in fact, the best Welsh silica bricks will not stand all the heat that can be produced. If water gas produces the temperature stated, no material now in commerce would stand many days; consequently the cost of maintenance would be enormous." The writer promises that on a future occasion he will give his experience of actual working with water gas.

Responding to the foregoing letters on the 21st inst., "Gas" writes: "Mr. Thwaite repeats what he said in his previous letter in other words. He now writes 'that, owing to the high thermic value of water gas, only half the thermal units are required to effect a given thermo-fusion work, that is required when producer gas is used.' If Mr. Thwaite had said that only half the weight, or quantity, of water gas was required as of producer gas to do a certain amount of work, I might have agreed with him; whilst still drawing attention to the fact that producer gas is only about an eighth the cost of water gas. With regard to Mr. Frederick Siemens's letter of August last, 'Steel Maker,' in his letter of May 12, speaks more highly of the relative commercial value of producer gas, as compared with water gas, than even Mr. Siemens himself did. I know that the figure he quotes, as to quantity of coal used per ton of steel melted on the open-hearth in Wales, is correct; but I have no experience of the use of water gas, and shall hail with satisfaction 'Steel Maker's' promised letter on the subject. With reference to Bischof's producer, so far as I know, it never went beyond the experimental stage; and Mr. Thwaite and myself agree that the reason of its failure must be attributed to the circumstance that it was worked by chimney draught, or suction. This producer being quite unknown to manufacturers, it would have been pedantry on my part to have referred to it."

RE THE GAS INSTITUTE.

SIR,—The following letter has been addressed by me to the Presidents of the District Associations of Gas Engineers and Managers; and you will be conferring a favour upon me by publishing the same in the next issue of your valuable JOURNAL.

CHARLES W. HASTINGS.

22, *Buckingham Street, Strand,*
London, W.C., May 22, 1889.

[COPY].

22, *Buckingham Street, Strand,*
London, W.C., May 21, 1889.

To the President of the ————

Dear Sir,—I beg to inform you that, upon the resignation by Mr. W. H. Bennett of the office of Secretary of The Gas Institute, I offered my services as Secretary *pro tem.* I have now addressed the following letter to each member of the existing Council:—

> "It will be within your remembrance that I offered my services as Secretary *pro tem.* of The Gas Institute, I am still quite willing to accept the office of Secretary should you and your colleagues deem me eligible for such position. Many members would, I am sure, give my candidature very hearty support; and I can but think that my services would be of considerable assistance to the Institute."

Should the Council or any members of The Gas Institute see fit to approve my nomination, I trust I may count upon your support, and that of the members of the Association over which you so ably preside.

Yours faithfully,

(Signed) CHARLES W. HASTINGS.

MELBOURNE WATER SUPPLY.—The daily consumption of Yan Yean water at Melbourne was 13,660,000 gallons in 1885, 14,709,000 gallons in 1886, 16,222,000 gallons in 1887, and 20,670,000 gallons in 1888; while from Jan. 1, 1889, up to the end of March, it was at the rate of 26,000,000 gallons per diem. The increase in the consumption since 1885 is attributed to the development of Melbourne and the suburbs during the past three years. The quantity of water supplied per head of the population has been 55 gallons each day, which includes water used for manufacturing and other purposes.

MALTA AND MEDITERRANEAN GAS COMPANY.—In the report of the Directors of this Company for the year ending the 31st of March last, which will be presented at the ordinary general meeting of shareholders on the 11th prox., it is stated that notwithstanding the reduced price charged for gas at Malta during the year, the rental increased; but there was a decrease in the amount received for coke. In order to meet the greater demand for gas, arrangements have been made for the construction of a new gasholder at Malta, and for some extensions of works at Corfu. From the balance available for disposal, the Directors recommend, after providing for the payment of the usual dividends upon the preference capital, a dividend of 4 per cent. upon the ordinary capital, which, added to the interim dividend of 2 per cent. already paid, will make a total of 6 per cent. for the year; leaving to be carried forward the sum of £514 11s. The Directors allude with regret to the death, in November last, of Mr. Edward Thorman, the Company's Engineer and General Manager; and they record their appreciation of his valuable services. The vacancy caused by Mr. Thorman's death has been filled by the promotion of the Chief Cashier, Mr. J. W. Starkey, to the office of General Manager; and of the Second Engineer, Mr. G. Soler, to that of Engineer.

* See JOURNAL, Vol. XLV., p. 861.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MAY 20.

The Bury Corporation Bill was withdrawn from the Committee to which it was referred on the 9th inst., and referred to a Select Committee consisting of Viscount Hardinge (Chairman), the Earl of Pembroke and Montgomery, Viscount Leinster, Lord Manners, and Lord De Mauley; to meet on Thursday, May 23.

THURSDAY, MAY 23.

The Gas Provisional Orders Bill and the Water Provisional Orders Bill were read a second time.

The following progress was made with Private Bills during the past week:—

Standing Orders complied with: Long Eaton and District Water Bill, Gas Provisional Orders Bill, Water Provisional Orders Bill.
Bills read the first time: Belgrano (Buenos Ayres) Gas Bill, South Kent Water Bill, Woodhall Spa Company Bill.
Bill read a second time: Long Eaton and District Water Bill.
Bills reported: Belfast Water Bill, Heywood Corporation Bill.
Bills read the third time and passed: Edinburgh and District Water Bill, Faversham Gas Bill, Great Wigston Gas Bill, Rastrick Water Bill.

HOUSE OF COMMONS.

WEDNESDAY, MAY 22.

THE PROPOSED ABOLITION OF THE LONDON COAL DUES.

On the order for the second reading of the Bill brought in by Sir J. Pease on Feb. 22 last (see *ante*, p. 392) to "abolish any duties on coals leviable by the Corporation of London,"

Mr. BAUMANN asked whether it was in accordance with the Standing Orders and the practice of the House to alter the powers and the charter-rights of a Corporation otherwise than by a Private Bill.

The SPEAKER said the Bill before the House had been carefully examined, and he had come to the conclusion that it might properly be introduced as a Public Bill.

Sir J. PEASE then moved the second reading of the Bill. He said that in the remarks he was about to make he hoped the House would bear in mind that he did not bring any charge whatever as to the way in which the money arising from the dues had been expended either by the Metropolitan Board of Works or by the Corporation of the City of London. He merely treated this as a great public question, which concerned not only the Metropolis, but the entire trade of the country, and especially the coal-producing district. On the 5th of July next the last of a long series of Continuation Acts, by which 1s. 1d. per ton was levied on all coals entering the Metropolis, would expire by efflux of time. These dues had been applied, with the direct sanction of the House, by both the City and the Metropolitan Board of Works, in Metropolitan improvements. The Bill for which he asked a second reading provided that on the expiration of the Continuation Act of 1868 these dues should cease, and that the power to levy them should not be revived. For many years it had been the intention of that House, the recommendation of every Royal Commission and Committee which had sat upon the question, and the opinion of every eminent statesman who had considered it, that these dues ought not to be revived in any shape or way. The new County Council of London had already decided, by 74 to 34 votes, that they ought not again to be levied upon the Metropolitan area. The honourable member then traced in much detail the history of the dues from the first Charter given to the Mayor, commonalty, and citizens of London by James I., in 1606, empowering them to exercise the office of measuring coals and other commodities, to the second Charter of the same monarch in 1615, when 8d. per ton was allowed to be levied for weighing, and down to the Act of 1831. The Act of 1831, he said, contained a clause which brought his Bill into the House—a clause which revived the rights of the Corporation at the expiration of the term, or whenever the sum of 1s. should cease to be paid. By an Act of George III., 1d. per ton on coals was granted for building a new Coal Exchange in London; and therefore the history of the 13d. of the present day was before the House. Having thus given the history of the dues, he wished to call attention to the manner in which these dues had long been complained of; and the real object of the Bill was to prevent this complaint ever arising after the 5th of July next. This 13d. was collected now on all coals coming into the Metropolitan Police area, which extended over 700 square miles—from Waltham on the north to Epsom on the south, and from Dartford on the east to Staines on the west (from 1851 to 1861 it extended over a still wider area); and therefore the 9d. appropriated so long was collected over 700 square miles, to be spent over an area of 120 square miles, while the City had had the advantage of 4d. a ton collected over 700 square miles, to be spent over one square mile. Surely, never in the history of taxation was there anything so unjust or so unequal. This area embraced the Corporation of West Ham, which complained that this tax was equal on their manufactures and their whole district to 16d. in the pound, in addition to all the other rates to which they were subjected. Yet West Ham had an independent Corporation. It was a tax which incommoded and did injustice to every poor man who required a ton of coals for his winter's fire. It was equal to a duty of from 10 to 15 per cent. on the poor man's coal and that consumed by the manufacturers of gas, while it represented only 4 per cent. on the coals used by the rich. Indeed, he calculated that it was a 15d. tax on the poor man's coal. His own constituents complained of it as interfering with the industry in which they were engaged. It did not affect him personally, as he was not one of those coal-owners who sent many coals to London; and therefore he would leave that part of the case to be dealt with by others. The tax, again, was of most serious detriment to all those trades in London in carrying on which coal was consumed. The London Chamber of Commerce, by a unanimous decision, had petitioned in favour of the Bill. The London Gas Companies complained of the tax. The three Metropolitan and the 12 Suburban Gas Companies used close upon 3,000,000 out of the 12,000,000 tons of coal brought into the City; and they paid in actual dues, after making allowances for drawbacks, a sum of £128,000. This was a most improvident tax in relation to the gas companies, because, of the advantages which would accrue from the abolition of the dues, probably one-fifth would go to the gas companies and four-fifths to the consumers. Even if London had to pay higher on the rateable value of premises in consequence of the abolition of the dues, he contended that the ratepayers would be more equitably taxed than by the continuance of this impost. It seemed to him that 20 years hence no one would believe, except on reference to history, that in London, the centre of financial ability, a tax was levied during the most enlightened portion of the century which fell more heavily on the poor than on the rich, which was an article of primary domestic use, which jeopardized and crippled its commercial interests, and was opposed by those interested in the staple trade in the north. He next showed that both by the Act of 1831, and especially by the Acts of 1861 and 1863, the control of Parliament had been exercised over every penny of this tax; that Parliament strictly stated the objects to which it was to be applied; that if there was any balance Parliament should control it; and that the times of its operation were limited. The Act of 1868 continued the levying of the dues, but not for 15 years, as was the case in 1845, not for ten years as in 1861 and 1863, but for seven years. The subject of Metropolitan taxation was receiving great attention at this time, and the inequality of the coal tax was complained of. In 1866 a Select Committee was appointed which consisted of 15 members. On the 12th of April of that year a draft report prepared by the Chairman condemned the coal and wine duties, and proposed their immediate abolition. An amendment, however, was moved by the present Duke of Rutland, to the effect that these duties might be beneficially continued for a further limited period. At the time of the renewal of the dues in 1861, the 9d. tax amounted to £161,000; in 1863, to £168,000; in 1868, to £184,000; in 1884, to £302,000; in 1887, to £325,000. He contended that every claim which Parliament had laid upon the coal dues had been specifically met and dealt with. As to the Holborn Valley improvements, he personally had a rather warm side towards the City of London in that matter. At the same time he did not see how they could levy a tax over 700 square miles in order to carry out that work. If, however, that question stood alone, he should be disposed to make some allowance for the City of London; but he wished to point out at the same time that if public improvements were needed, the money for them could be raised in a better and fairer manner out of the rates, as was the practice with other corporations in the country, and by a fair levy on the property of the people who inhabited the district. This would be a much more equitable method of securing the end in view. After referring to the reports of several Select Committees of the House on the subject, the honourable member stated that a Royal Commission which sat in 1854 expressed a strong opinion against a longer continuance of the dues. The matter, he said, had also during the last few years been brought before successive Ministers of the day, among them being the right honourable member for Mid-Lothian and the late Lord Iddesleigh, who entered into correspondence with Lord Magheramorne, when he was Chairman of the Metropolitan Board of Works, in regard to the objections to the dues. The present Chairman of Ways and Means (Mr. Courtney) when Secretary to the Treasury, also signed a minute which deprecated, both to the Corporation of London and to the Metropolitan Board of Works, any renewal of the dues. Then, further, there was the very celebrated memorandum that was delivered by the noble Lord the member for Paddington (Lord Randolph Churchill), when he answered a deputation that waited upon him on the subject. The noble Lord pointed out that there were objections to a tax of that kind of a very formidable character. He remarked that it was a tax on a necessary of life, thereby involving principles of taxation of which in this country they had long sought to get rid; that it was a very high tax; and that, before a responsible Government could make itself a party to asking Parliament to renew it, it was necessary that it should be shown that the case for the expenditure they meant to meet by the tax was one of overwhelming necessity, or that more legitimate sources of taxation for the purpose were not available or were exhausted. The noble lord further said that without any doubt an equal rate on property for public objects would be far less objectionable than a tax on a necessary of life. The present leader of the House (Mr. W. H. Smith) had also taken a very strong view on the subject, and had stated that he would regret to see the continuance of a tax which would be in any degree a check on enterprise, or on the employment of the inhabitants of the Metropolis, and would place them at any disadvantage as compared with other districts of the country. He thought he had made out his case. The object of the Bill was to prevent, by any side-wind of the Corporation, a tax of this antiquated and obsolete character being again placed upon the industries of the Metropolis and upon the poor of London.

Sir R. FOWLER said he was anxious to make a few remarks with regard to the position which the Corporation of London took up on this subject. He did not propose to move the rejection of the Bill, but to support the amendment which stood in the name of his honourable friend the member for Peckham (Mr. Baumann). He wished to point out that the Bill came before the House as a measure which was entirely supported by the colliery interest. It was a Durham Bill; and it was introduced because it would be a great advantage to that district if the coal dues ceased. He had, however, to look at this question as it affected the interests of the Metropolis. The Corporation had always taken one line on the subject of the dues, which they considered were of great advantage to the Metropolis, although the County Council seemed to take rather a different view. The Corporation believed that the large majority of the people of the Metropolis, as represented by their members in the House, took the same view as they did, and they were not therefore prepared to dissociate themselves from those representatives. He did not think it would be disputed that there would be a large increase in the rates if the dues were abolished. He would give some statistics to show that there had already been a rise in rates owing to the approaching cessation of the tax. He found that in the present half year there was an increase in Bow (St. Mary, Stratford) of 2d.; Islington (St. Mary), ¾d.; Limehouse (St. Ann), 2d.; Hampstead (St. John), 3d.; Hackney (St. John), 7d.; Shoreditch (St. Leonard), 1d.; St. Pancras, 5d.; St. Giles's-in-the Fields, 6d.; St. Martin's-in-the-Fields, 3d.; St. James, Westminster, 2d.; Southwark (Christchurch), 6½d.; Putney, 8d.; Wandsworth, 9d.; Camberwell, 5d.; Newington, 1d.; St. George's, Hanover Square, 4½d.; St. Luke, Middlesex, 4½d.; St. Margaret and St. John, Westminster, 1d.; Lambeth, 10d.; St. John, Horselydown, 3d.; and St. Mary, Battersea, 5½d. The rateable value of the Metropolitan area, including the City, last year was nearly £31,000,000. A rate of 3¾d. on this amount—making allowance for empty houses and cost of collection—would produce £435,750. The coal dues produced last year £450,000. It could therefore be seen what rate would be required to make up for the loss of the dues. They had heard a good many pathetic appeals with regard to the price paid for coal. Let them look at the case of a householder occupying a house rated at £150 a year, and burning 72,000 cubic feet of gas and 20 tons of coal per annum. One penny per 1000 cubic feet saved on the gas amounted to 6s., and 1s. 1d. a ton on the coal amounted to £1 1s. 8d.—a total saving of £1 7s. 8d. An additional rate of 3¾d. on his house amounted to £2 6s. 10d.; showing a loss to him of 19s. 2d. by the abolition of the dues. A householder rated at £50 a year and consuming 25,000 cubic feet of gas and 8 tons of coal, showed a loss to him of 4s. 10½d. It was said that the abolition of the dues would bring about a reduction in the price of gas; and they knew that the gas companies were exceedingly anxious that the Bill should pass. Of the whole amount of the present duty, the gas companies together paid about £125,000 annually, or a little more than one-fourth; but their payment of this duty was taken into consideration when, under their different Acts, their sliding scale of dividend was made to depend upon the particular scale of charges fixed by those Acts. Before this Bill could become law, therefore, it would be necessary to revise these scales. This was a point which deserved the consideration

of the House. It must be obvious that a large increase of rates must follow the abolition of the coal dues, and honourable members who had advocated the cessation of the tax would have that increase thrown in their faces when they came to solicit re-election. The Corporation of London had, he thought, a claim for the consideration of the House if the dues were suddenly cut off, if their ancient rights were disturbed, and if they were not allowed to carry on the great improvements in reliance upon an ancient source of revenue. They did not see why they should give up any of the rights they possessed, especially considering the admirable manner in which the money derived from this source of revenue had been employed by them.

Mr. JOICEY thought that the arguments in favour of the Bill were unanswerable. He had listened with surprise to the accusation made by the honourable baronet (Sir R. Fowler) to the effect that the Bill before the House had been promoted in the interests of the Durham coal-owners. He thought the honourable baronet was certainly not the man who should make a charge of that kind. Whom did the honourable baronet represent? He represented the City of London, which had received something like one-third of the whole of the dues produced by the tax, and received entirely in the interests of one square mile, as compared with the 700 square miles in which the tax was collected. He denied that the abolition of the tax would lead to general increased taxation of the community; quoting at the same time a report of the Metropolitan Board of Works to the effect that, if the dues were abolished, the increase of rates over the area where the dues were collected would be 2¼d. in the pound. Those who favoured the Bill did not object to the improvements which had been referred to. They believed, on the other hand, that these improvements would not cease, but would be continued even if the dues were abolished. They also maintained that the poorest people in the Metropolis should not bear a very unfair proportion of the taxation in order to permit of those improvements being carried out. As to the Gas Companies, he quoted a letter from the Chairman of the South Metropolitan Company, in which it was stated that the Company were prepared to give the whole advantage of the remission of the tax to the consumers of gas. If the dues were abolished, and the old tax of 8d. per ton on coal was substituted by the Corporation, he believed it would create even greater inequality than existed at the present time. In the first place, the tax would be paid almost entirely by the sea-borne coal. At present there was a drawback of 1s. per ton, which every coal merchant received if the coal passed beyond the area—say, to Tunbridge Wells or Romford. The Bill was intended to prevent people who had no representation, and who lived beyond the area of present taxation, from having a fresh taxation of 8d. per ton imposed on them. He maintained, in opposition to the preceding speaker, that the consumers really paid the tax; and, as a matter of fact, the real pinch of it fell upon the employed as distinguished from the employers. The tax prevented the extension of trade which was the sole interest the mining industry had in proposing its abolition. It was a relic of old times which ought to be swept away; and the burden it created fell on shoulders least able to bear it.

Mr. BANMANN moved, as an amendment—"That, having regard to the increased rate which the London County Council has found it necessary to levy upon the Metropolis, it is expedient to coptinue the coal dues for a limited period, until the Council has had an opportunity of thoroughly investigating the liabilities it has taken over from the Metropolitan Board of Works and the resources of the Metropolis." He said he proposed his amendment as a compromise between the immediate abolition and the indefinite retention of the coal dues. The effect of it would be to defeat the Bill; but it would also bind the House, so far as the House could be bound by its own resolution, to pass another measure during the present session to continue the dues for a limited period. He presumed that Her Majesty's Government would afford facilities for the introduction of such a Continuance Bill. But if the honourable baronet (Sir J. Pease) or any of his friends would give an undertaking that they would alter the date from 1889 to 1891, and allow the insertion in Committee of another clause providing for the continuance of the coal dues at 1s. 1d. per ton for a limited period of two years, he would ask leave to withdraw his amendment; otherwise he would take the sense of the House upon it. It was true that the dues had been condemned by the London County Council; but he spoke on behalf of the ratepayers. The case of the ratepayers was a very simple one. The coal dues last year produced £450,000. A rate of 3¾d. in the pound would produce £430,000; a rate of 4d. in the pound would produce £465,000. The income required to make up the expiring coal dues must be provided by the Metropolis. The money must be made up, not merely to prevent the stoppage of public improvements, but because of the debt charge, amounting to more than a million a year. The County Council did not pretend they could do without the money; they had boldly added to the rates. He denied that the poor would benefit by the abolition of the dues. They would not, and could not get their coal cheaper; while they must bear an increase of rent consequent on the increase of the rates. All that he asked was that the duties should be extended for a limited period, until the County Council had found something to put in their place. He failed to see why the ratepayers of London should be sacrificed to the coal-owners of Durham, or fleeced to satisfy the fads of a few economic theorists.

Mr. R. G. WEBSTER, in seconding the amendment, contended that the Bill had been brought forward solely at the instigation of rich coal-owners and wealthy proprietors of gas undertakings. He maintained that it would be greatly to the advantage of the working men to have the coal dues continued, because if they were abolished very little would, he said, be gained by the reduction of the price of coal, while there would be an increase in the rates. He thought the County Council would, in two or three years' time, be unable to overlook the growing impatience of the inhabitants of London if they caused the rates to go up, as they would go up, if the Bill passed into law. Of the 61 members sent by the Metropolis to Parliament, 44 were returned practically to support the coal dues; and he submitted that if a large number of those who voted in the County Council in favour of the abolition of the dues had an opportunity of reconsidering their vote, with full information before them, they would alter their view of the matter. In the interests of the ratepayers of London, he opposed the Bill.

Mr. H. W. LAWSON said the County Council elections last January were fought on the question whether the coal and wine dues should be abolished; and the House knew the result. The opposition to this Bill came from the City and its satellites; and the City has taken upon itself, through its Remembrancer, to issue a memorandum which was transparently dishonest. In order to induce honourable members to vote against the Bill, the memorandum stated that a rate of 3¾d. in the pound would be imposed upon the rateable value of the whole Metropolis to make up for the lapse of the dues. But it must be remembered that 4d. fell to the lot of the City, and only 9d. to the rest of the Metropolis; and, therefore, the bulk of the money would have to come from the City itself. It seemed to be forgotten that the grant made by the Treasury towards local taxation would almost compensate for the loss of the coal and wine dues. From this grant, the London County Council would receive £255,000, and they would lose £320,000 from the dues; so that in reality less than a ½d. rate was the total addition which would ever accrue to the ratepayers of London owing to the abolition of the dues. The dweller in the West-end got off more cheaply than the poor, because the former had to pay upon coals at 24s. per ton, while the latter had to pay upon coal at 8s. and 11s. per ton. The tax, too, was unequal in its incidence upon industries and upon localities. The City obtained nearly one-third of the whole tax, while the rest of the Metropolis had 9d. for its uses. The truth was the tax was indefensible from any point of view. It was bad in principle, obsolete in its methods, and its effect was harassing and injurious to the interests of the Metropolis.

The HOME SECRETARY said the Government had more than once assumed the position that the maintenance or abolition of the dues was purely a local question. Whether the Metropolis preferred this indirect taxation, or would rather have the burden in the form of direct taxation, was a matter for the Metropolis itself; and from the principal of neutrality the Government did not desire to depart. It must not be forgotten that these statutory dues, expiring in July, had nothing to do with the present Bill, which did not operate one way or the other with regard to the statutory 1s. 1d., which had been in existence from 1831. What the Bill purported to do was to take away, without inquiry and without compensation, the suspended rights of the City of London which had been hitherto kept alive by Parliament. The position the Government were disposed to take was this: That they could not assent, without more inquiry and more information than the House possessed, to take away ancient prescriptive and immemorial rights belonging to the Corporation of the City of London, and which certainly were exercised for the public benefit and the public good—he did not say necessarily without compensation (it might be that the City of London, on consideration, would not require compensation), but at any rate without ascertaining that they were not doing wrong to somebody. Therefore, if the forms of the House would allow it, he proposed to move—"That a Committee be appointed to inquire what title the City possesses to levy tolls on coal within the port of London; whether any debts or liabilities have been incurred on the security of dues; and how, with proper regard to existing rights and to the public interests, such dues can be dealt with."

Sir J. PEASE asked whether the right honourable gentleman would be willing to have the Bill read a second time, with the instruction he had suggested to a Committee.

The HOME SECRETARY said it was his intention that the Committee should be appointed before the Bill was read a second time.

Mr. COURTNEY said it was most inexpedient, injurious, and unjust to the Metropolis to continue these dues. They adversely affected trade; and they were also an injurious impost on the poor. He had no difficulty in voting for the cessation of such an indirect tax. But this was not the only question involved in the Bill. It sought to interfere with the chartered rights of the City of London in a way in which they would not interfere with any other body; and he thought the obligations of the City ought to be fairly considered by a Committee. These questions were not suitable to be discussed in a Committee of the Whole House; and he would suggest that the Bill be read a second time, and afterwards referred to a Hybrid Committee, where the Corporation could be heard, and their obligations examined into.

Sir H. HAVELOCK-ALLAN appealed to the First Lord of the Treasury to accept the suggestion of the Chairman of Committees.

Mr. W. H. SMITH said the Home Secretary had stated that the view of the Government was that inquiry should precede legislation on this matter. There were 60 or 70 Corporations in the United Kingdom which were possessed of powers similar to those enjoyed by the City of London; and to deprive them of those powers, without having regard to liabilities incurred in consequence of the existence of these revenues, would, the Government considered, be unjust, without full inquiry being instituted. But the Chairman of Committees had made a suggestion which seemed to him to embrace the views of the Government—that the Bill should be read a second time and referred to a Hybrid Committee of a judicial character, with full powers to examine into and deal with all the circumstances of the case, and put into the Bill clauses necessary to meet the liabilities which had been incurred by the City in consequence of the existence of these dues. This appeared to him to be a compromise which the House might very properly accept. The Government had not at any time expressed an opinion in favour of the continuance of the dues, and he knew there were many people in London who were opposed to them. Under legislation passed by the Government last year, the ratepayers of London had elected a County Council, which had, by a considerable majority, declared against the dues; and in view of this fact, it would be inconsistent on the part of the Government if they turned round and voted for the amendment of the member for Peckham. He trusted the honourable baronet opposite (Sir J. Pease) would consent to the reference of the Bill to a strong Hybrid Committee.

Sir J. PEASE intimated that he had consulted with his friends, and they were ready to accept the second reading of the Bill; after which he would, he said, move that the Bill be referred to a Select Committee, subsequently to be changed to a Hybrid Committee.

Mr. RITCHIE said he had always opposed this impost, which bore heavily on the taxpayers in the East-end of London. He objected to the tax because it was unequal; and it was in the interests of all classes of the community—manufacturers and employers as well as the working classes—that it should cease to exist.

On a division, Mr. Baumann's amendment was rejected by 104 to 264.

Sir J. PEASE then moved that the question be now put.

This was agreed to without a division, and the Bill was read a second time amid cheers.

Sir J. PEASE moved that the Bill be referred to a Select Committee.

An objection having been raised by Mr. Bartley, the motion was postponed till next day.

BOROUGH FUNDS BILL.

The order for the second reading of the above-named Bill, the object of which is to amend the 35 and 36 Vict., cap. 91, relating to the application of funds of municipal corporations and other governing bodies in certain cases, was read and discharged, and the Bill withdrawn.

BRIBERY (PUBLIC BODIES) PREVENTION BILL.

This Bill was considered in Committee and reported.

THURSDAY, MAY 23.

THE BOARD OF TRADE AND ELECTRIC LIGHTING PROPOSALS.

Sir G. CAMPBELL asked the President of the Board of Trade whether Mr. Calcraft's letter of May 18 regarding electric lighting in the Metropolis (*ante*, p. 955) correctly expressed the present intention of the Board of Trade to adopt Major Marindin's proposals to set aside the provisions of the Act of Parliament of 1888 requiring the previous consent of the local authority in many cases; whether the Board of Trade had approved the proposal of Major Marindin that the mere objection by a local authority should not be considered sufficient to exclude any company unless the local authority was itself ready at once to undertake the supply of electricity, and gave evidence of its intention to do so; whether this

alone will be sufficient ground for a special report in each case stating grounds for dispensing with the consent of the local authority as required by the Act; whether, in case he finally determined to give concessions to companies without the consent of the local authorities, he would take care that his special report on each case was laid before Parliament in sufficient time, and that sufficient opportunity was given to Parliament to deal with the matter before the general provisions of the Act of 1888 were specially overriden, and powers given to promoters in the Metropolis without the consent of the local authorities; and whether he would also take care that no expressions were introduced in Provisional Orders inconsistent with the provision of the law that no concession should in any way hinder or restrict the local authority from at any time undertaking the supply of electricity in the same area, if they should think fit to do so.

Sir M. Hicks-Beach said Mr. Calcraft's letter correctly expressed the present intention of the Board of Trade. Major Marindin's report, however, did not go so far as was suggested in the second clause of the question. If in any case the consent of a local authority was dispensed with, the special report of the Board of Trade would be laid at the earliest possible moment before Parliament. It would not be consistent with the provisions of the Act of 1888 to insert in any Provisional Order any clause injuring or restricting the subsequent granting of a Licence or Provisional Order to the local authority or any other person within the same area.

THE PROPOSED ABOLITION OF THE LONDON COAL DUES.

The adjourned debate on further proceedings consequent on the second reading of the Coal Duties (London) Abolition Bill was further adjourned till the 27th inst.

Friday, May 24.

BRIBERY (PUBLIC BODIES) PREVENTION BILL.

This Bill, as amended, was considered, read the third time, and passed.

The following progress was made with Private Bills during the past week:—

Standing Orders complied with: Cleveland Water Bill.
Bill read the first time: Rastrick Water Bill.
Bill reported: Belgrano (Buenos Ayres) Gas Company Bill.
Bills read the third time and passed: Belgrano (Buenos Ayres) Gas Bill, South Kent Water Bill, Woodhall Spa Company Bill, Yeadon Water Bill.
Petitions withdrawn: Burnley Corporation, against the Padiham and Hapton Local Board Bill, Padiham and Hapton Local Board, against the Burnley Corporation Bill, Whickham Local Board and John Giffard Riddell, against the Newcastle and Gateshead Water Bill.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* Henley, *Chairman*; *Earl* Lauderdale, *and Lords* Balinhard, Zouche of Haryngworth, *and* Kinnaird.)

RASTRICK WATER BILL.

The objects of this Bill are to dissolve and re-incorporate a limited Company; to repeal the provisions of the Halifax Corporation and Improvement Act, 1868, which empower the Corporation to supply water in the district; to authorize the Company to raise £9000 of additional capital, with £4250 borrowing powers; and to construct further works.

Mr. Balfour Browne, Q.C., and Mr. Freeman appeared for the promoters; Mr. Bidder, Q.C., Mr. Pollock, and Mr. Coward for the Rastrick Local Board, who opposed the measure.

The Bill first came before the Committee on Tuesday, April 2, when Mr. Balfour Browne stated the case for the promoters, and mentioned that it was proposed to adopt the provisions of the Water-Works Clauses Act, which would limit the dividend to 10 per cent. on the old, and 7 per cent. on the new capital. Seeing that the Company had been paying from 14 to 15 per cent. dividend, the scheme he pointed out would be for the public advantage. Dealing with the petition of the Local Board, which stated that the water proposed to be supplied was impure, Counsel quoted the opinion of Dr. Bond, the medical adviser to the Local Board, to the effect that the water was very good and exceedingly suitable for domestic purposes. He contended that the sole object of the petitioners in being present was to cripple the promoters and to buy the undertaking at an unfair and cheap price. Mr. Bidder, referring to the last observation, said that Mr. Browne had not told an important part of the story—viz., that the parties had actually met and agreed upon terms of sale. He thought that it was a rather strong thing to ask the Committee to go on with the Bill when the parties had entered into an agreement to drop it. Mr. Freeman said the agreement was drawn up without prejudice; and as the parties could not come to an agreement, the promoters had proceeded with their Bill. After a long discussion, it was decided to adjourn the case to enable the parties to come to some agreement, if possible. On the following Friday, the proceedings were resumed, when Mr. Browne read a clause which the promoters had offered to insert in the Bill; but it had been refused. The Chairman said that it was evident that both parties were not in a negotiating frame of mind. The Committee did not impute any wrong to either party. Negotiations were set on foot and failed; and the Committee were now quite ready to put the parties in the same position as they were before the negotiations were started. The consideration of the Bill was then adjourned *sine die*.

Tuesday, May 14.

On the resumption of the proceedings this morning,

Mr. *G. H. Crowther*, examined by Mr. Freeman, said that he was the local Engineer of the Rastrick Water Company. He gave details of the water supply in the past, from the formation of the present Company, with a capital of £6000, down to their obtaining a clause in the Halifax Corporation Bill last session, when the price of the water to be supplied by Halifax to Rastrick was to be 5d. per 1000 gallons; Rastrick being required to fix its maximum demand, and being also required to take one-half that maximum as a minimum. One of the objects of the present Bill was to empower the Company to construct a reservoir which would enable them to store about 4 million gallons of water, by which means they would be able to utilize all the water taken from Halifax, for which the manufacturing requirements varied very much in winter as compared with summer. He considered the Company ought to be invested with parliamentary powers.

Cross-examined by Mr. Coward as to the prices of water charged in Brighouse as compared with Rastrick, witness said that the Brighouse charge was 7s. 6d., as compared with 8s. 8d. in Rastrick, for houses under £5 rental. There had been a penny reduction in the price of the water taken from Halifax, the whole of which had been given to the consumers. The Rastrick prices for domestic purposes might previously have been from 50 to 100 per cent. more than Halifax prices within the borough; but they were as much less compared with the Halifax charges outside its borough. Witness knew that a petition had been drawn up against the Bill, but was not aware that 1400 out of the 2000 ratepayers had signed it.

Re-examined by Mr. Balfour Browne: The object of the proposed new reservoir was to ensure the utilization and regular supply of the water. He had never heard of a larger offer than £7000 from the Local Board for the property, which was ridiculous. If the Company were swept away, the Halifax Corporation, and not the Local Board, would have the right to supply Rastrick.

Dr. *C. Meymot Tidy* was called, and gave evidence as to the quality of the water which the Company proposed to utilize. He said he considered it to be a perfect water—superior to that of Halifax.

Drs. *Bond* and *Jarmain* also gave evidence as to the nature of the water, supporting the opinion expressed by the previous witness.

Mr. *A. T. Clay*, manufacturer, of Rastrick, gave evidence as to the formation of the original Company in 1870; witness's father being the first Chairman of the concern. Since that time there had been a great increase in the population of the township. The Company had been of great service; indeed, if things had gone on as they were going at that time, his firm would have had to remove their works altogether. He believed that the passing of the Bill was most essential to the prosperity of Rastrick.

Cross-examined: In 1870, though the Local Board would do nothing to provide a water supply, a number of the members assisted in the promotion of the Water Company. At first there was no dividend. Last year 8 per cent. was paid. The reason why the Company came for the present Bill was that Rastrick, having doubled in size, additional mains must be laid, and the capital of the Company was about exhausted.

Mr. Balfour Browne, in reply to the Committee, said that the Company had no right at present to lay mains. They had laid them hitherto by arrangement with the Local Board; but it had been decided that the Board had no legal power to grant the privilege.

By the Committee: His own opinion was that the Company should be granted the powers asked for, and that a clause should be inserted empowering the Local Board to buy the water-works at a certain number of years' purchase.

Wednesday, May 15.

Mr. *J. Paskin*, examined by Mr. Balfour Browne, said that he was the Resident Engineer of the Halifax Corporation Water-Works. The charges for water at Halifax and Huddersfield outside the borough were higher than the Rastrick Company's charges on small rentals. The 5d. per 1000 gallons charged by Halifax to Rastrick witness said he considered an exceedingly low price.

Cross-examined: Witness said that the agreement of Aug. 3, 1870, between Rastrick and Halifax, would be superseded if the Committee passed the Bill. Witness agreed generally that it was desirable for all local authorities to have the matter of water supply in their hands; but Halifax would not supply the Local Board at 5d. if the concern was transferred. It would be difficult to say whether or not Halifax lost on its supply to Rastrick at 5d. The Halifax Corporation works were capable of supplying 5 to 6 million gallons a day; and they were only using about 4 million gallons.

Mr. *J. Taylor*, the Secretary of the Company, was called, but was not examined. In reply to Mr. Pollock, he said he had been Secretary since 1873. He was Clerk to the Local Board at the time of the formation of the Company. At the meeting held on Oct. 6, 1869, witness thought that four or five of the promoters of the concern were members of the Local Board. Witness had voted against the water supply being in the hands of a private Company, thinking it ought to be in the hands of the Local Board; but he was not of that opinion now.

This closed the case for the promoters; and evidence for the opponents was proceeded with.

Mr. *G. Helm*, examined by Mr. Pollock, said that he was the Chairman of the Rastrick Local Board. The Local Board were strongly opposed to the powers of the present Bill being conferred on the Company; and he thought that nine-tenths of the district supported the Board on this point. The Bill repealed the power of Halifax to supply water in Rastrick; and they objected to that.

Mr. Freeman, for the promoters, pointed out that there was another agreement with Halifax in the Bill.

Mr. Pollock said that that was rather a matter for argument; but the Bill would remove from Halifax the duty of supplying water. The Local Board's point was that it objected to the duty being taken from the public authority and given to a private company.

Examination continued: Witness thought that at one place the water proposed to be taken by the Company was contaminated in an open pool accessible to cattle. He was of opinion that the capital of the promoters was now large enough.

Cross-examined: Witness said the Local Board had power to prevent the contamination at the pool.

Mr. *Sugden* said that he had been Chairman of the Brighouse Local Board; and the charges in Brighouse for water were less than those that the Rastrick Company proposed.

Mr. *C. Gott*, M. Inst. C.E., deposed that, in his opinion, the Company's charges were higher than the Local Board would have to make if it were the water authority.

Mr. Bidder appealed to the Committee not to "penalize" the consumers of water in Rastrick by empowering the Company to charge from 25 to 50 per cent. more than the consumers in adjacent districts had to pay. He asked their Lordships to reject the Bill, or, if they passed it, to put it upon a proper footing with regard to rates, and to give power to the Local Board to purchase the undertaking. The Local Board were willing to give 20 years' purchase, or what an arbitrator decided.

Mr. Balfour Browne, in reply, said the Company might be swept away if statutory powers were not granted, as they had now no power to break up the streets, and then the rates charged by Halifax for places outside the borough would have to be paid. The Local Board had thrown upon the Company the enormous expense of the present proceedings; and the offer made at the very close of Mr. Bidder's speech was only thrown out to induce the Committee to reject the measure.

The Committee decided that they would pass the preamble of the Bill, subject to the insertion of a clause enabling the Local Board to signify their intention of buying within two years either by agreed terms or, failing that, by arbitration; and it was stated that the promoters would accept that condition, and go on with the Bill.

Reductions in Price.—The *Hebden Bridge Gas Company* have resolved to reduce the price of gas from 3s. 4d. to 3s. 1d. per 1000 cubic feet.——The *Padiham Local Board* have reduced the price, as from the 25th of March last, from 3s. 4d. to 3s. per 1000 feet, with discounts ranging from 5 to 10 per cent.

The Projected Electric Lighting of Folkestone.—In consequence of the refusal of the Directors of the Folkestone Gas Company to waive their agreement in favour of a scheme of partial electric lighting, the Folkestone Town Council have given notice of the termination of the contract for lighting the streets with gas. It will end in July next year; and pending its expiration the Corporation have determined to do all in their power to promote the success of electric lighting.

Legal Intelligence.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

WEDNESDAY, MAY 22.

(*Before Mr. Justice* WILLS *and a Common Jury.*)

EASTCOURT *v.* THE EAST LONDON WATER-WORKS COMPANY.

This was an action brought by a blind man to recover compensation for personal injuries sustained by him from falling into a hole made by the Company, in the ordinary course of their business in the pavement in a street in Bethnal Green, which, as the plaintiff alleged, was negligently left by them insufficiently fenced. The defendants denied they had been negligent, and attributed negligence to the plaintiff.

Mr. HORNE-PAYNE, Q.C., and Mr. RAWLINSON appeared for the plaintiff; Mr. DICKENS for the defendants.

The plaintiff, by the fall, had one of his knees injured; and it was a question with the doctors whether it was not of a permanent nature, so as to interfere with his business. He had been making a living of about 15s. a week from blowing an organ in a church and selling small books in the streets. The negligence attributed to him by the defendants was in his going about without any person or dog to guide him, and to not feeling his way carefully enough with his stick. The Company had offered the plaintiff £10; but this was declined.

Justice WILLS pointed out that the question of negligence in the plaintiff would depend very much on whether there was any particular ground for suspecting danger.

The jury returned a verdict for £85; and his Lordship gave judgment for this amount, with costs.

WOODHALL SPA GAS COMPANY, LIMITED.—This Company has lately been registered with a capital of £4000, in £5 shares, to acquire land at Woodhall Spa for the construction of gas-works.

EXTENSION OF THE DERBY GAS-WORKS.—The Derby Gas Company are having their works extended by the erection of a new purifying-house; and more commodious office accommodation is being provided.

SALES OF SHARES.—At the Auction Mart, E.C., last Wednesday, Messrs. Edwin Fox and Bousfield sold some shares in the following Gas Companies:—*Epsom and Ewell* £25 fully paid shares, at £45 to £46 each. *Northfleet and Greenhithe* original "A" stock at 216 per cent. *West Kent* £10 fully paid ordinary shares at £20 10s. to £21. *Grays* ordinary "B" shares, £10 each, fully paid, at £11 10s.——At a recent sale by Messrs. Wetherall and Sons, of Hartley Wintney, £70 of original "A" stock in the *Basingstoke Gas Company*, on which for some time a dividend of 10 per cent. has been paid, was knocked down for £155; £35 of stock on which £5 per cent. has been paid fetching £40.——At a sale of shares at Chatham last Friday, two lots of £100 fully paid-up stock in the *Maidstone Gas Company* fetched £234 each. A similar lot, with only £87 paid up, realized £200. Seven fully paid shares of £5 each in the *Brompton, &c., Water Company* were sold for £16 2s. 6d. each. Eight similar shares realized the same amount per share; and eight other similar shares changed hands at £16 per share. Two £5 shares in the same Company, on each of which £1 had been paid, were sold for £10 7s. 6d. each.——An important sale of gas stock in the *Torquay Gas Company* has lately taken place; the stock offered being 250 £10 shares (7 per cent.)—a further portion of the capital authorized by the Company's Act of 1878. Of the entire number, 60 shares fetched £14 each; 105 realized £14 1s. each; 50 more, £14 2s. each; and 35, £14 3s.—the average price being £14 1s. 3d. per share. The total sum realized, including premiums, was £3515 10s.

THE BARNET LOCAL BOARD AND THEIR ELECTRIC LIGHTING CONTRACTOR.—At the meeting of the Barnet Local Board last Tuesday, a letter from Messrs. Ingledew, Ince, and Co., Solicitors to Mr. Joel, the electric lighting contractor, was read. The communication stated that while Mr. Joel desired to meet the Board in every reasonable respect, he reserved all his rights under his contract. The contract provided that he should apply for and obtain a Licence from the Board of Trade, and that the Local Board should assist him in doing so. The non-compliance of the Board with this provision would prevent Mr. Joel from putting the wires underground within twelve months, as required by clause 5, and the Board must therefore release him from the obligation. Upon Mr. Joel's obtaining the Licence, it would give him an interest extending over seven years in lieu of the three years provided by the Board, which would satisfy him for the large expense to which he had been put. Messrs. Ingledew also pointed out that the terms of the resolution passed on the 25th of April last (*ante*, p. 873) had been very prejudicial to Mr. Joel in his endeavour to make the lighting a success, and appeared to have been unjustified by the facts. Had the Board desired to defer for a time their consent to the application for a Licence, it might have been done without casting a stigma upon Mr. Joel, who now asked that the resolution should be rescinded. The Chairman (Mr. C. Stevens) said Messrs. Ingledew had just hit the point. The Board did not assist Mr. Joel to obtain a Licence for the very reason that it would give him seven years' tenure instead of three. Mr. James proposed that, as legal points were raised, they should, in the absence of their Clerk, refer the matter to the Lighting Committee, in conjunction with the Clerk. This was agreed to unanimously.

PADIHAM LOCAL BOARD GAS SUPPLY.—At the last meeting of the Padiham Local Board, the Gas Committee reported that they had resolved to reduce the price of gas, as from March 25, from 3s. 4d. to 3s. per 1000 feet, being subject to discounts of 10 per cent. for large, and 5 per cent. for small consumers. Mr. Holland, in moving that this resolution be confirmed, said it was a mystery hard to explain that one portion of the ratepayers should be taxed, as the consumers of gas were, for the benefit of another portion. The gas undertaking was entered into for the advantage of the whole district, not for that of those who would not use gas; and the whole district should have the benefit of cheap gas. The report of the Manager (Mr. J. R. Smith) showed that during the year cottages and shops had consumed 19,154,500 cubic feet, and mills 11,044,900 cubic feet of gas; while in the public lamps and on the works they consumed 2,854,200 cubic feet—making the total 33,053,600 cubic feet. The income was £6288 6s. 5d.; the expenditure, £3181 15s. 2d. Then there was a permanent charge of £1722 6s. 2d. for interest and the sinking fund; and if to these items there was added the £386 11s. 11d. allowed as discount for prompt payment, there was a balance profit of £937 13s. 2d. Mr. Smith averaged the expenditure on repairs for four years, thereby reducing the profit on the undertaking to £799 19s. 5d.; but he (Mr. Holland) preferred to treat repairs as ordinary expenditure out of revenue, which brought down the amount of profit to £546 19s. 11d. A sum of 4d. per 1000 cubic feet on 30 millions would mean a reduction of income of £500. They had, however, only 1615 consumers out of 2550 houses in the district; and though he did not expect that immediately the prices were lowered all the remaining 935 houses would commence to use gas, he hoped that some would. The resolution was carried.

Miscellaneous News.

ELECTRIC LIGHTING IN THE METROPOLIS.

BOARD OF TRADE INQUIRY.

(*Before Major* MARINDIN, C.M.G., R.E., *assisted by Captain* CARDEW.)

THIRTEENTH DAY—THURSDAY, APRIL 25 (*continued*).

Mr. *T. H. Cole*, examined by Mr. CRIPPS, said he was a member of the Strand District Board of Works, and also of the Special Electric Lighting Committee which that Board had appointed. As a member of the Committee, he was cognizant of all that had taken place with regard to the electric lighting question in the Strand. In the present year there had been before the Board applications for Provisional Orders from five different companies; and the Committee had mainly devoted their attention to the London and Metropolitan Companies. Generally speaking, the Electric Lighting Committee thought that the financial position of these two Companies was such that probably either of them would be able to carry out a system of electric lighting in the district. Communications were opened up with both Companies in identical terms as far back as November of last year; and the Committee had since inspected the stations of the two companies. He was aware of the general condition and traffic of the district; and had some knowledge of the condition of the sewers, gas and water pipes, and telegraphic and telephonic communications under the streets. The Committee had formed the opinion that there was not room certainly for more than two sets of mains. After thoroughly discussing the question at their numerous meetings, they came to the conclusion that the interests of the consumers and the public were not sufficiently looked after, and that it would be better for the District Board to make some definite arrangement with the Metropolitan Company.

Cross-examined by Mr. PEMBER, witness said that although one of the members of the Strand District Board of Works was a Director of the London Electric Supply Company, he had never sat at the Committee meetings. He did not think the Committee were always in favour of having only one Company in the district. They were, in fact, desirous of putting both on an equal basis; and he personally endeavoured to give them a perfectly fair hearing.

Mr. PEMBER: You never informed my Corporation that you had entered into an agreement with another Company.

Witness: No; we had very good reasons for that. We looked upon the agreement with the Metropolitan Company in the light of a contract; and therefore it would have been a breach of faith to make known that contract to someone else. Witness continued that he had never held that it would be wise to have a monopoly; but he thought it would be wise to accept the terms of the Company which would be most advantageous for the district.

Do you consider this arrangement as a model form suitable for electric lighting generally?—I have simply viewed it in the light of the special conditions and requirements of the Strand, and not from a general point of view.

What are the needs of the Strand?—The needs of the Strand are that it is one of the most important thoroughfares, with great traffic running through it.

This agreement is really an elaborate piece of private Bill legislation, suitable for the Strand District Board of Works, and an endeavour to get as much as they could out of the Company?—Yes, I suppose so.

Do you know that Parliament has not in any legislation hitherto fixed the price for lighting?—I have no knowledge of that.

There is nothing special in the Strand as against any other part of London which should render it necessary or advisable that the price should be fixed?—Except it be for the advantage of the Strand district.

Then, again, there is nothing in connection with any special local condition of the Strand which would render a penalty necessary for any deviation of pressure from time to time?—I presume that is a matter which we thought out and considered necessary in the interest of the district and the consumers.

Mr. CRIPPS: It has been suggested that, for some occult reason, you were, or are, inclined to put the Metropolitan Company on a better basis than the London Electric Corporation?

Witness: Personally, I endeavoured to give to each Company a perfectly fair hearing.

And were you prepared to treat the two Companies on precisely the same basis?—Yes.

Mr. Fowler's name has been mentioned. Has he the remotest connection with the Metropolitan Company?—No; not that I am aware of.

In answer to Mr. HUNTER, M.P., witness said the Strand District Board of Works desired to give a fair field and no favour to all companies. The Electrical Power Storeage Company was set aside as one of the companies which did not satisfy the requirements of the Electric Lighting Committee. They did not take any special steps to ascertain the financial capability of the Storeage Company; but their opinion was that they could not have five or six companies pulling up the streets.

Mr. HUNTER: Did your Committee when they entered into negotiations with the Metropolitan Company understand that they were to supply motive power as well as light?

Witness: We were a Lighting Committee, and dealt with lighting only.

Did you consider, in view of the large number of theatres and public buildings in the district, which system of electric lighting was best suited for them?—We saw the example of the Company we had selected, and that was in perfect working order; and we considered it the most efficient.

Was that at Whitehall Court?—Yes.

Do you know that that was the storeage system?—There was storeage. There would be no storeage for the Strand. What we learnt of storeage was rather against it; and it did not meet with our approval.

Am I to understand that the only reason you rejected the Electrical Power Storeage Company was that the name indicated its particular system?—Yes.

Do you not see that the effect of your agreement is to override the Board of Trade?—We have no desire to do that. We hope the Board of Trade will join with us in the advantages which we have, to a certain extent, obtained for the consumer. We have no wish whatever to put ourselves in antagonism with the Board of Trade.

Mr. W. W. YOUNG then stated the objections of the Wandsworth District Board. The Board did not appear there as objectors to the preamble of the Metropolitan Company's Order, but were anxious to stimulate companies coming into their district. They desired to have certain clauses inserted in their Order for the protection of the parishes under the Board. First, as regarded capital, Mr. Balfour had stated in his evidence that the capital of the Metropolitan Company was £500,000, and that £350,000 of that was committed. He did not desire to assert that the capital of the Company was insufficient; but as there was only £150,000 in hand, he thought the Board of Trade should—in view of the fact that the Wandsworth area was a large one of about sixty miles of streets—consider whether a sum of money should not be deposited or further capital raised by the St. James's Order. Then his Board were anxious to have a clause

inserted providing that the undertakers should not at any time, without the previous consent of the local authorities, acquire or undertake the purchase of any other company's or individual's business which proposed to supply electricity to the district. Then with regard to the generating stations, this might be considered a large request—viz., that the local authorities should have a veto as to their erection; but it should be borne in mind that they might be a great nuisance to the neighbourhood, and depreciate the value of the property. The agreement obtained by the Strand District Board acknowledged the right of such a veto; for they had agreed upon the two sites for the generating stations. His Board did not wish to fix the Company to a particular road or street; but there should be a limited area, and the local authorities should have the power to say whether or not they approved of the area. In clause 7 of the Order, there were certain provisions for opening the roads for works and for repairs, and there was no provision as to giving notice of such opening. In the Metropolis Management Act and in the Gas-Works Clauses Act, there were clauses providing for the opening of the roads for gas and water which applied generally to the Metropolis; and he asked that that clause might be inserted in the Metropolitan Company's Order.

Mr. CRIPPS said that the Gas-Works Clauses Act did deal with the matter, but not precisely in the same way.

Mr. YOUNG: The gas and water companies are bound by these provisions; and there is no reason why the electric lighting companies should not be also bound in a similar way. He then said that his Board objected *in toto* to overhead wires, which were a source of considerable danger. Again, the Board were very anxious that the Metropolitan Electric Lighting Company should be compelled within a certain time to lay down mains in the chief thoroughfares of the district, in order that the roads might be scheduled. As to testing-stations, they were provided by gas companies, and so they should be by electric lighting companies. There should also be a penalty paid by the Company in case of a defective supply; for it was very important that the supply should be a reliable one. They might give a defective supply to the consumers and get off without any penalty, unless there was some clause in the Order to prevent it. That penalty ought also to be paid to the local authorities, as they would have to incur the expense of prosecuting the companies if necessary. Another important point was as to the charges; and his Board thought a clause should be inserted for a sliding scale of charges. The principle of a sliding scale had been already recognized; but he did not say whether the scale should come into operation at once or at the end of seven years. With regard to the price, it was rather in excess in the St. James's Order. Last year it was 7d.; but by the present Order, they asked that it should be 8d. His Board now requested that it should be 7d. as last year.

Mr. *Arthur Southam*, Surveyor to the Wandsworth Board of Works, then gave evidence as to the importance of the Order containing similar provisions to those embodied in the Metropolis Management Act as to the opening of roads.

Mr. H. WILKIN, in opening the case for the St. James's Vestry, said he proposed to deal with questions of policy rather than with technical matters. In St. James's this question of electric lighting had been under consideration for a long while; and the Vestry had already consented to two or three Orders and Licences. Up to the present year not one of them ever actually came into operation; and the supply of electricity under the statutes did not commence until this inquiry had actually been opened. The Vestry had never assumed an attitude of antagonism to the electric light; but they insisted upon certain conditions. Since 1882 the question had been more or less under consideration; and the views of the Vestry had assumed a definite form. The first question considered was whether they should adopt a system of free trade or of districting the companies. He considered districting as essential in the case of electric lighting as ever it was in the case of gas, and perhaps more so. In the early days of gas lighting, there was a great waste in expenditure; and the public had to pay for it in the increased cost of gas. It might be said that the circumstances of electric lighting were somewhat different to the condition of gas companies when districting took place; but he was not at all sure that the difference was worth considering. He had been informed that there were several gas-mains in Piccadilly; and then there were other pipes of whose existence the gas companies knew nothing. Even if the principle of competition were admitted, effective competition would be physically impossible, for there would be no room to lay the mains. So that they had arrived at this point—that, although in theory it might be thought wise to apportion London between the different companies—to district London—it was a question whether they could say that any particular system of electric lighting was applicable to any particular area. The conclusion arrived at by the Vestry was that while in theory the wiser course to pursue, alike to consumers, shareholders, and the local authorities, would be to eventually acquire the undertakings at the end of 42 years, yet they had not arrived at the stage at which they could say that a certain company was the best for any particular district. So far back as 1882, when the Electric Lighting Bill was introduced, scientific experts said that the electric light had passed from the theoretical into the practical stage. But in answer to that, he would point them to the dynamos used in the early days of electricity, and as regarded their commercial value, compare them with the less expensive ones now largely in use. But were they even now really out of the experimental stage? The whole system of the London Electric Supply Corporation was experimental. They were to have dynamos larger than ever before attempted. They were to use a rigid concentric main which would be jointed at every 20 yards; and it was admitted that at every 20 yards there would be a weak point in the system. And they had besides a potential of 10,000 volts—a potential never yet attempted except on a small scale, whereas with the Corporation it was to be an attempt extending over seven miles. There was also to be generating stations which were likewise to be to some extent experimental. The serious question therefore arose whether it was wise to entrust the Corporation with such a large area as they desired, upon which to make so gigantic an experiment. The St. James's Vestry had had during the past year applications from five companies, and came to terms with two of them. Those terms were not lightly arranged, but formed the subject of repeated conferences extending over ten weeks between the promoters of the different undertakings and the representatives of the Board of Trade and the Vestry. The result was that, although the Vestry had not obtained all they desired as the local authority, they were content with a fair working compromise which was adopted last year; and at any rate, until experience advised differently, they were content to go on on those terms. They had adopted two competing Companies—the St. James's using the continuous-current low tension, and the Metropolitan Company the high-tension alternating system; so that they would have competition in current as well as in management. In this the Vestry had adopted a middle course, and had gone in neither for free trade nor districting, because they thought the time had not arrived when any fair system of districting could be adopted. They had the experience of the gas companies in the past to guide them in their negotiations for obtaining a supply of electric light for the district. The learned Counsel then read a report which had been drawn up by a Special Committee on the subject of the lighting of the district by electricity, in the course of which they said: "One very important point to which your Committee have directed their attention is the possibility of the Gas Companies' undertakings eventually proving less remunerative in the poorer portion of a parish owing to the withdrawal of the large consumers in the principal streets, to whom expense may not be so much an object as the greater cleanliness and coolness which are anticipated from the adoption of the electric light. In that case the mains would have to be charged with gas as at present; and it is evident that the area and cost of distribution would be proportionately increased as the length of unprofitable mains extended. In such a case the price of gas would probably rise; and the increased cost would mainly fall upon the consumer in the poorer localities. It is indeed possible for the poorer locality to be deprived both of gas and electricity; for, under the provisions of the Electric Lighting Act, the Board of Trade may relieve a gas company of their obligations to supply gas in an area sufficiently supplied with the electric light if such an area has become unremunerative, while the price of electricity, and the conditions attached to its supply, may be a serious impediment to small householders. This contingency may be removed. Nevertheless your Committee think it a point of such importance as to deserve the consideration of the Vestry, and to engage the attention of the Board of Trade." The learned Counsel went on to refer to the subject of overhead wires. He contended that it was not absolutely certain whether they could be legally used, and then said that not far short of one-half of the parish would require the current not so much for light as for power, so that it was important that any company supplying electricity should be able to meet that want. Objecting in detail to the Corporation system, he said that the very vastness of its operations would be likely to lead to a monopoly. The system was not sufficiently applicable for power. The potential of 10,000 volts reminded him of bottled lightning. There were the many joints and the long distance from the station; and as to insulation, they were not satisfied that proper precautions had been taken for an effective insulation of the enormous potential. Among the electrical problems not yet solved satisfactorily was the consequences of leakage to earth; the interference with other electrical communications; and the varying tensions. Another objection was that the Company proposed to take a large area and supply moment by moment every bit of electricity from their station, and using it to their fullest extent; so that, if any breakdown occurred, there would be no reserve to fall back upon. In favour of the station at Deptford it was said that gas companies had gone out of London and supplied their gas from outside areas; but there was this important difference that in regard to the supply of gas, although it was manufactured mostly at Beckton and Fulham, yet they had reserves in other places, and the possible event of a strike or of an explosion wrecking the Deptford station was not quite so remote as Lord Crawford and Sir William Thompson seemed to think. It was further urged that great economy would be effected by having the station at Deptford; but that was more apparent than real. He thought the price to be charged would be even more than if supplied from stations in the district to be served. The principal objection to the London Corporation scheme was that it was a huge experiment from first to last, as far as dynamos, distance, concentric mains, rigidity of mains, insulation, and the double conversion were concerned. And the Vestry would very much prefer that the experiment should be kept out of their area. In conclusion, he said that the Vestry had agreed with two Companies, with the view of getting the maximum of convenience and the minimum amount of waste; and it would enable them to satisfactorily solve the question of districting at the earliest possible period. They would rather be without the London Corporation; but if they obtained their Order, and included St. James's, then he urged that the competition should be based upon the same terms as the other competitors had accepted.

Mr. *J. Swinburne* was then recalled.

Mr. WILKIN: I think you heard Mr. Ferranti give evidence, and speak of the economy which would be effected by the central station at Deptford?

Witness: I did.

With regard to the economy of coal, do you think that would be considerable?—I think, taken in relation to the whole cost of the coal, it would be some two or three shillings a ton; but there are other points to be considered.

But supposing we had a station in St. James's, or within a very short distance—just the other side of the water, for instance—what difference would that make?—If you had a railway siding or motor siding that advantage would disappear. I mean that you are on the same footing then as you would be at Deptford, practically.

Then I think you said the price per ton was not the only consideration?—No; because if you use inferior coal, you need larger boilers, which mean more capital expenditure, and you require more coal to give you a certain amount of steam.

So then a lower price of coal might be counterbalanced by other expenses?—To some extent. It would not be wholly counterbalanced; but it would be practically counterbalanced.

Mr. Ferranti said: "Our coal is half the price." Do you think that could be borne out by any experience whatever?—Half price seems to me too large a reduction by far.

Are you aware that Deptford is within the Metropolis for the purpose of the Smoke Nuisance Abatement Act?—I believe it depends whether the central station of the undertakers is within the Burial Acts' definition of the word "Metropolis." I think the Deptford station is within that definition; and if that is the case, of course you cannot use the cheap coal at this station. You would have to use the same quality of coal at Deptford as you do in the central portion of the Metropolis.

So that the argument founded upon using coal of a cheaper kind falls to the ground?—Certainly, as far as the smoke abatement goes.

I think a comparison was made with the coal used by gas companies. Can any comparison be fairly drawn between the coal used for the manufacture of gas and for generating electricity?—No; it would not be a fair comparison, because the cost of coal in the case of gas would be a very much larger proportion of the total cost than it is in the case of electricity; and, in addition to that, you have the double cartage in the case of gas companies, because you have to get rid of the coke again when you have finished.

Are you prepared to give the proportion?—I think in the case of a gas company it would be something like 30 per cent.; and in that of an electric lighting company, it would be something like 20 per cent. With the electric light company it depends on the system used to some extent; so that it is rather a wide figure.

With regard to distance from London, do you think it is an advantage or a disadvantage to the consumers to have headquarters seven miles away from the source of supply?—I should say from a consumers' point of view, it is a very serious disadvantage. I should not like to take power from a company which was seven miles off, especially in such a direction as Deptford. If I had to transact business with the office, I should not care to have to run down to Deptford to see them.

Is it not possible, being seven miles distant from the supply, that you

might have summer weather at Deptford while the West of London was in intense darkness?—It would be conceivable. I do not know exactly how the fogs go over London; but I believe they are partial.

Supposing such a state of affairs to exist, and the people at Deptford were in ignorance of the condition of the atmosphere here, their first intimation of it would be simply by an increased draft of their current. Under those circumstances, would the additional distance be an advantage or a disadvantage to the consumer?—The distance would be a disadvantage there. I think, however, the station will be able to cope with it.

Would it increase the cost at all?—The distance from Deptford would very materially.

Evidence was given that the proportion of the cost of bringing the current up from Deptford would be 7 per cent. on the capital outlay at the generating station?—Yes, I remember that figure.

Taking the mains as given by Mr. Ferranti, what do you estimate the cost of one main from Deptford for seven miles, the hypothetical distance, would be?—It is rather difficult to estimate it; but £14,000 is a very low estimate indeed. I have here a piece of cable of the same area manufactured by the Silvertown Company who are one of the leading companies. It is an india-rubber insulation—it is the same area; and the price insulated inside is £2500 a mile; but if you insulate it outside as well, it comes up to £5000 or £6000 a mile. That is an extreme case, because the insulation they would put on would be probably better than the London Electric Company would require; but I think you may take it that £14,000 is rather too low a figure.

Taking the cost of a station of 100,000 lights and the cost of distribution at £150,000, what percentage do you make the cost of the mains bear to work out somewhere about the 18 per cent.?—Something near 20 per cent. as compared with 7 per cent. That is assuming you take the mains as given by Mr. Ferranti; but in another part of his evidence, he took the saving as one-fifth of 1 per cent. per mile—that is, I mean the loss of energy is one-fifth per cent. per mile, instead of one-half as I make it. If you take larger cables to agree with this data, the price would become fabulous.

That is to say with the cables, as proposed by Mr. Ferranti, it will be impossible to work them with the small amount of loss which he claims?—Yes.

And to reduce the amount to his estimate, the cost, instead of being £14,000, would be something more?—Something very much larger—four or five times larger.

On your present estimate the cost would be 18 per cent., as compared with Mr. Ferranti's 7 per cent.; and if the mains were larger to reduce the loss, the percentage would be even higher than the 18 per cent?—Yes.

Take Lord Crawford's evidence as to the cost of mains, £1000 a mile, allowing for share in the idle trunk.—I did a calculation for that. I think £1000 a mile is too small.

I am taking Lord Crawford's evidence—now your estimate is £2000 a mile?—Yes.

Taking Lord Crawford's estimate of £1000 a mile, it is just half; and allowing £5000 for share in the idle main, and the 12s. 6d. which we have taken as the average cost of excavation, the extra cost, you say, is £18,200?—£18,200 is the cost of the mains. In that calculation I assumed the cost of the station at Lord Crawford's estimate also, which was £1 per light, and you get another figure of that percentage at Lord Crawford's own figure. Lord Crawford's estimate of £1 per light comes, instead of 7 per cent., to something like 20 per cent.

Of course, you would say those figures are accurate?—Only rough estimates—hypothetical cases. I think I have taken them quite low enough to give a fair idea.

You spoke just now of Mr. Ferranti's estimate of loss at 0·2 per cent. You estimate the loss on the present trunk at what?—0·5 per cent. per mile; or in the 7 miles about 3·6 per cent.

Then as to this loss in conversion from £10,000 to £2400, what would be the loss of energy there?—Mr. Ferranti took it at about 2 per cent., which I think is about right, so there would be about 2 per cent. to be added; making, instead of 3½ per cent., a total loss of nearly 6 per cent. This is exclusive of depreciation of these high-tension mains.

At such a potential as 10,000 volts, would the depreciation be large or small?—I cannot say exactly what it would be; but the chances are it would be larger than if the volts were lower. It may be anything almost, it is a very difficult thing to say, because one cannot say for certain whether that insulation will stand. If the insulation takes to breaking down, the percentage becomes enormous immediately.

You mean to say that you cannot estimate the loss because it is an experiment at the time?—Precisely. I should say that it is over 10 per cent.; it might be 10 per cent. onwards to anything.

The total saving was estimated at 50 per cent. Upon what items would it be possible to save?—You would save in the first instance for rent, and if you had a large space for storing coal, you would supply your fuel stations if storing was necessary in each case, and you would save slightly in superintendence, and so on, but to a very small extent; and there is a saving in coal compared with a station to which the coal has to be carted, or even brought by train.

Cross-examined by Mr. GRAHAM, witness said the question of loss in conversion was entirely a matter of calculation; but indirectly he had made some experiments. Beyond that it was a matter of calculation. It was some advantage to have condensing engines in point of economy.

Mr. GRAHAM: Mr. Ferranti says that in the case of coal he is going to effect an economy of 100 per cent., because he is going to work under such advantageous conditions.

Witness: It was with the Grosvenor Gallery; but not with any other systems of electric lighting. I do not think he could have meant that there was 50 per cent. saving in going to Deptford pure and simple, compared with having his own station in town.

Several very eminent electrical gentlemen, amongst others Mr. Preece, Mr. Ferranti, and, I think, Dr. Hopkinson, said that, although there was no alternating-current motor at present well known, they had no doubt there would be one discovered shortly; in other words, there were no electrical impossibilities to be overcome?—There is no electrical impossibility; but I have paid a great deal of attention to the subject myself, and I have been working at it some time. There is no electrical difficulty in it; but the difficulty of making an alternating motor that will start. There is not much difficulty in making a small alternating-current motor that will work fairly up to 1-horse power.

Mr. WILKIN: With regard to the economy of generating a current at Deptford, as compared with the local stations, will you let me put the question in this way: Do you consider the cost of generating a current at Deptford and bringing it up to St. James's would be very different from generating it in St. James's?—I think, on the whole, the balance would be in favour of generating it in St. James's; but something depends upon whether you can get the coal by train or not.

Major MARINDIN: Mr. Swinburne, in criticizing Mr. Ferranti's figures as to the saving in the coal at Deptford, you did not, I think you told Mr. Wilkin, make allowance for any saving in wages. I mean in the saving of working at Deptford no allowance is made as to wages at all?—I said superintendence; perhaps I missed wages. I think this is an exceedingly small matter. The question of wages, when you are dealing with a very large concern, is, of course, something; but still it is small.

Mr. HITCHINS, who appeared for St. George's, Hanover Square, observed that the only witness he proposed to call was the Vestry Clerk.

Major MARINDIN said that was tantamount to saying that Mr. Hitchins was not prepared to go on.

Mr. HITCHINS replied that he was prepared to go on; but merely wished that he should be allowed to call the Vestry Clerk the next morning. Having received sanction to this course, he (Mr. Hitchins) stated that the Vestry had negotiated with three of the companies. Four companies in all proposed to take powers over the parish. The first was the London Electric Supply Corporation; the second was the Metropolitan Company; the third, the Westminster Company; and the fourth, the Chelsea Company. As regarded the London Supply Corporation, the Vestry had been negotiating with them in regard to the form of an Order; and certain objections had been sent in by the Vestry to the Board of Trade, to which the Company had agreed.

Major MARINDIN remarked that there was no occasion to go into the objections made to that Company.

Mr. HITCHINS proceeded to say that the Vestry had delivered certain requisitions and suggestions for amending the Metropolitan Company's Order, which were all agreed to. There was, however, one subject with reference to a sum or deposit which it was proposed instead of being put in the Order should form the subject of an agreement between them. The Vestry did not object to that; and it was a question for the Board of Trade. As to the Westminster Company, so far as he could gather from the evidence of the previous day, they had withdrawn their application so far as regarded the parish of St. George's.

Major MARINDIN observed that he did not understand the Company had withdrawn.

Mr. HITCHINS said the Company had withdrawn from certain districts; but perhaps he was wrong in assuming that they had withdrawn from the whole.

Major MARINDIN, after hearing Mr. Loyd, said the Westminster Company had abandoned the whole scheme, excepting St. Margaret's and St. John's, Westminster, and St. George's, Hanover Square.

Mr. HITCHINS said the Vestry were willing that this Company should come in with the other two Companies; and here again the Company had in writing agreed to the conditions of the Vestry. The only other Company was the Chelsea Company, who proposed to take a small portion of the parish which the Vestry considered the picked district; and inasmuch as there were already three Companies consented to, the Vestry considered it undesirable that a fourth Company should be allowed to come into the district to interfere with the public traffic and with the streets. They therefore objected to that Company coming in, because it was not necessary for competition; that being already secured. The Vestry did not propose to offer any evidence on the scientific part of the question, which they were willing to leave with the Board of Trade.

The inquiry was again adjourned.

THE LONDON COUNTY COUNCIL AND ELECTRIC LIGHTING MAINS.

At the Meeting of the London County Council last Tuesday—Lord Rosebery in the chair—the Highways Committee reported that they had had before them a notice by Messrs. Latimer Clark, Muirhead, and Co., Limited, that, in pursuance of powers conferred on the St. James's and Pall Mall Electric Light Company, Limited, under Licence granted by the Board of Trade, they proposed to lay electric light mains and distributing boxes under certain thoroughfares in the parish of St. James, Westminster—viz., Piccadilly, Piccadilly Circus, Regent Street, St. James's Square, Pall Mall, St. James's Street, King Street, and Duke Street. The Vestry of St. James's had already consented to the laying of the mains referred to in the notice, and the Committee recommended that the consent of the Council be likewise given, on condition that the work should be carried out to the satisfaction of the proper authorities. Mr. Haggis moved that the recommendation be approved. To this an amendment was proposed that the matter be referred back to the Committee; the seconder (Mr. Lloyd) stating that if the Council had the power they should only give their consent on conditions similar to those laid down by Major Marindin in his report on electric lighting in London. Mr. Haggis said the Committee, of which he was the Chairman, had before them the whole question of the electric lighting of the Metropolis. The recommendation in their report was, however, with reference to a Company who had already had a Licence granted to them by the Board of Trade, and therefore that Company had the right to lay the mains and boxes of which they had given notice to the Council. The amendment was agreed to.

THE ELECTRIC LIGHTING SCHEME FOR BIRMINGHAM.

It will be remembered that at the commencement of the present year the Birmingham City Council were occupied in the consideration of a report of the General Purposes Committee upon the application of Messrs. Chamberlain and Hookham for a Provisional Order to authorize a scheme of public and private electric lighting. The promoters of the Order sought to obtain a concession of the entire city; but the General Purposes Committee could not see their way to consent to this, and sought to limit the Order to a restricted area, composed principally of what is known as Market Hall Ward. They also desired that the promoters should be required to form a Company with at least £50,000 capital—a sum to which the promoters would only consent if the entire area of the city was included in the Order. Upon the Council adopting the recommendations of the Committee, it was generally understood (says the *Birmingham Post*) that the promoters regarded their requirements as placing insuperable difficulties in the way of the scheme, and that the latter was therefore abandoned. The scheme, however, is still in existence; and there is a reasonable probability of its being carried into effect. Messrs. Chamberlain and Hookham have not withdrawn from the promotion of their Order, which, after various communications with the Board of Trade and the General Purposes Committee, has practically arrived at its final form. The Board of Trade consider the area suggested by the Corporation a reasonable one; and they have also set down the capital to be provided at £50,000. The Committee submitted that this amount ought to be £100,000; but they have, acting under the authority given to them by the Council, consented that the Provisional Order shall stipulate for one-half that sum. They have also given way upon some matters of working detail; and last Monday, at a meeting of the Committee, approval was given to the draft Order as amended by the Board of Trade.

EXTENSIONS AT THE ILKLEY GAS-WORKS.—Extensions are being made at the works of the Ilkley Gas Company, by the erection of two of Messrs. R. and J. Dempster's scrubbers, 7 feet in diameter, with all the latest improvements. The condensers are being added to; and this work has also been placed with Messrs. R. and J. Dempster.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday at the London Offices, 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS presiding.

The SECRETARY (Mr. A. Lass, F.C.A.) read the advertisement calling the meeting, and it was agreed to take as read the Directors' report and the statement of accounts for the half year ending Dec. 31 last, the principal points of which were noticed in the JOURNAL for the 7th inst., p. 873.

The CHAIRMAN moved that the report and accounts be received and adopted, and entered on the minutes. He said that these had been issued to the shareholders; and he did not think it necessary to take up the time of the meeting in going through them, as they appeared to be very satisfactory. He, however, expressed his willingness to answer any question that might be put to him.

Mr. C. GANDON seconded the motion, which was unanimously carried.

The CHAIRMAN then proposed the declaration of a dividend for the half year on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent. per annum, both less income-tax (except upon those dividends payable to the local shareholders).

Captain H. THURBURN seconded the proposition, which was agreed to.

The retiring Directors (Mr. Joseph Quick and Captain Thurburn) were re-elected, on the motion of the CHAIRMAN, seconded by Mr. ROBERT KING, the former of whom remarked upon the good service done by both gentlemen since the foundation of the Company.

Captain THURBURN having acknowledged the continued confidence of the shareholders in him and his co-Director,

On the motion of Mr. E. K. BLYTH, seconded by Captain THURBURN, Mr. King, the retiring Auditor, was re-appointed.

The CHAIRMAN said his last duty was a pleasing one not only to himself but, he was sure, to all present. It was to propose that a vote of thanks be passed to the Local Committee, which at present only consisted of Mr. R. P. Drysdale, to the Secretary (Mr. A. Lass), the local Secretary (Mr. F. A. Conyers), the Engineer (Mr. J. B. Younger), the Auditors (Messrs. R. King and C. Newton), and the Solicitor (Mr. E. K. Blyth). He expressed the hope that the officers would all live long to follow the good work which they had done in the past.

Mr. GANDON said from his intimate knowledge of what these gentlemen had done in the past, he was sure they deserved the thanks of the shareholders; and he had much pleasure in seconding the proposition.

The motion having been agreed to,

Mr. NEWTON briefly acknowledged the compliment on behalf of the officers. Proceeding, he moved a vote of thanks to the Chairman and Directors; observing that the absence of the shareholders showed they were perfectly satisfied with the results exhibited in the balance-sheet. It was true that in a company like that much depended upon the way in which the working officers carried out the directions of the Directors; but at the same time the Directors must give the instructions. The great care and management of the Board during the half year deserved the unqualified thanks of the shareholders.

Mr. KING seconded the motion, which was agreed to.

The CHAIRMAN returned thanks; and assured the proprietors that he and his colleagues would endeavour to do in the future what they had hitherto done—that was, to render the Company successful.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Thursday, at the London Offices, 7 and 8, Idol Lane, E.C.—Mr. EDWARD HORNER in the chair.

The SECRETARY (Mr. A. J. Head) read the notice convening the meeting; and it was decided to take as read the Directors' report and the statement of accounts for the half year ending Dec. 31. The revenue account showed that the total receipts amounted to £19,236, and the expenditure to £12,066—leaving a balance of £7170 to be carried to profit and loss. Adding to this the balance brought from the previous accounts made a sum of £8116 available for division; and after payment of the dividends recommended by the Directors, there will remain £866 to be carried forward.

The CHAIRMAN said that the figures in the present accounts were much the same as they had been on former occasions; but there was one advantageous item to which he would call the shareholders' attention on the capital side of the balance-sheet, and that was the reserve fund of £13,000. The money with which they had formed this fund was owing to the Company; and it had been paid since the last meeting. A reserve fund in a Company like theirs was a most desirable thing; and he was sure it would be highly appreciated by the shareholders—especially seeing that the whole of the £13,000 would be invested in first-class funds in this country. Some people might think it better to have bonds out in Brazil at a higher rate of interest; but personally he did not. He regarded the position of the Company as good; and to "back up" this opinion, he mentioned that he had added to his holding in the concern. He wished that the accounts were much better than they were; and he believed in course of time they would be. The only thing that was against the accounts was the falling off in the private consumption. The consumption by the public lamps, &c., was as good as usual. With respect to the manufacture, the amount of gas produced per ton of coal carbonized had not been quite so high; but whether this was owing to the quality of the coal he could not say. Instead of obtaining 9653 cubic feet of gas per ton as in the previous year, the average yield was only 9160 cubic feet in the past six months. The amount of unaccounted-for gas had not been so large; being only 8¾ per cent. They had used a little less coal. Alluding to the provincial bonds which the Company had held, he said that the net profit at various times on these bonds amounted to £257, £3120, and interest £3230—making the total profit £6607; so that this part of the account was not very bad.

Mr. FORDRED (interrupting) enquired if the whole of the bonds had been sold.

The SECRETARY said that they were all paid off by the Government in February this year.

Mr. FORDRED said that it appeared, by the balance-sheet, as if bonds were still held by the Company.

The CHAIRMAN pointed out that the balance-sheet only referred to the operations during the half year ending December 31 last; and these bonds had been redeemed since. He regarded the financial part of the concern as exceedingly good; and therefore he had much pleasure in moving—"That the report and statement of accounts now presented be and they are hereby adopted."

Mr. HORATIO BROTHERS seconded the motion.

Mr. FORDRED said he observed in the accounts that they had received something like £15,000 for gas; but only about £2000 for residual products. He should like to know if this was the right proportion, as he should have thought the residuals would have produced more money.

The CHAIRMAN said the receipts for the residuals varied from time to time.

Mr. A. J. KING remarked that what they realized for the residuals was about 50 per cent. of the cost of the coal used.

Mr. FORDRED asked whether it would pay to send the residuals to England, as they did not appear to obtain so high a price for the bye-products as in London.

Mr. HORATIO BROTHERS replied in the negative, and added that the tar and ammoniacal liquor were unsaleable in Bahia.

Mr. MAUD inquired whether the debts of the public establishments were higher than in the previous year. He saw that the item now stood at £2763, which was not far short of one-and-a-half year's consumption under this head, which for this half year was represented by £954.

Mr. KING replied that six months ago the item referred to stood at £2853; and twelve months ago, at £2768.

Mr. MAUD expressed the hope that they were not in any danger of letting these debts run as they did before. He thought the item was very heavy.

The CHAIRMAN said that he did not think it was. They had nothing now to oblige them to take bonds in payment.

Mr. BADOCK observed that he supposed, if the Board were to press for the money, they would get it.

Mr. KING said they did press for it. They ought to get it quicker; but they could not always avoid it running on a little.

Mr. FINLAY, reverting to the amount produced by the residuals, said he thought the item was very satisfactory. The coals carbonized cost £4439; and the residuals realized £2269, which was about 50 per cent. on the outlay for coals.

Mr. BADOCK remarked that perhaps it was not considered advisable to press the authorities too much for payment; inasmuch as they would have to look to them for another concession some day. He inquired how long it was before the Company's concession terminated.

Mr. HORATIO BROTHERS: Three years.

The motion was then unanimously carried.

The Chairman next moved the declaration of the usual dividends on the preference shares; and a dividend at the rate of 10 per cent. per annum (free of income-tax) on the ordinary shares.

Mr. KING seconded the motion, which was agreed to.

A vote of thanks was then accorded to the officers; and on the motion of Mr. MAUD, seconded by Mr. MAGNUS OHREN, a similar vote was passed to the Chairman and Directors for the attention they had given to the affairs of the Company during the half year.

The CHAIRMAN, in acknowledging the compliment, spoke of the great confidence which he held in regard to the future of the Company.

The proceedings then terminated.

COVENTRY CORPORATION GAS SUPPLY.

THE PAST YEAR'S WORKING.—A GOOD SURPLUS.

At the Meeting of the Coventry City Council last Tuesday—the DEPUTY-MAYOR (Alderman Maycock) presiding—the Gas Committee presented the following report:—"Your Committee submit herewith the accounts of the gas undertaking for the year ended the 25th of March, 1889. The reserve fund of £5000 was last year completed and invested in Consols. It will be seen that, after providing £1381 10s., the year's payment to the sinking fund, there is a net profit for the year of £2808 11s. 1d. available for the district fund in relief of rates. About two-thirds of the gas sold during the year was subject to the reduction in price of 3d. per 1000 cubic feet—a reduction which took effect from Michaelmas last. Notwithstanding this reduction, the receipts for gas consumed in the quarter ending the 31st of March were, owing to increased consumption, nearly up to the same amount as in the corresponding quarter of 1888. The increased make of gas over last year was 11,032,000 cubic feet; while the working expenses were within a few pounds the same. The increased consumption was 14,165,863 cubic feet; being an advance on last year of 7·30 per cent. The illuminating power of the gas during the year averaged 17·66 sperm candles; and the sulphur compounds, 11·66 grains per 100 cubic feet—both averages being practically the same as last year. The whole of the works and distributing plant have been kept in good working order and satisfactory condition."

Mr. ANDREWS, in moving the adoption of the report, remarked that it seemed only a very short time ago that the Corporation were negotiating for the purchase of the gas undertaking. Since then, however, the Gas Committee had been able, out of the profits, in the first place to pay £7000 into the sinking fund towards the purchase of the undertaking; secondly, to create a reserve fund of £5000; thirdly, to reduce the price of gas 3d. per 1000 cubic feet; and, fourthly, to present the payers of the district rate with the sum of £2808 to relieve their rate. This was equivalent to about 7d. in the pound on the rate. The Gas Committee would arrange to pay one-half the amount into the district-rate fund about September next, when the rate would be made; and the remaining half prior to the 31st of March next, to relieve the succeeding rate. Out of the year's revenue the Committee had also provided for a renewal of a portion of the purifying plant, so as to make it more capable of coping with the increased production of gas. The past year had been a favourable one. The consumption of gas had increased; and the Committee had obtained a better price for residuals. The loss of gas by leakage had also been smaller than usual. It would, however, be borne in mind that the Gas Department was a trading department, and subject to the fluctuations of trade the same as any other business. There was but little probability of the next balance-sheet showing so large a surplus profit as the present one, owing to the rise in the price of coal. Coal-owners were demanding 1s. 6d. to 2s. per ton advance. In addition to this, the railway rates for the carriage of coal were completely disorganized, or he might say demoralized, owing to the new Railway Rates Act; and coal-owners who paid the carriage were asking about 1s. 6d. per ton extra to cover themselves from loss on this account. As the Committee used more than 20,000 tons of coal per year, 3s. per ton would make a difference of £3000. Fortunately, however, a large portion of the coals for the present year's consumption was covered by contracts made in advance a year ago, and consequently would be obtained at old prices. The Committee hoped at no distant date to see their way clear to make a reduction in the tariff for hiring out the smaller sized meters, so as to encourage the use of gas in the lesser houses in the city. The business of the Gas Department was steadily increasing. The turnover was £31,200 when the undertaking came into the hands of the Corporation, but was now £36,500 a year; being nearly as large an amount as that of all the other departments of the Corporation put together. In conclusion, he said he desired to testify to the unwearied exertions of their excellent Manager (Mr. G. Winstanley, Assoc. M. Inst. C.E.), without whom this satisfactory result could not have been achieved.

Alderman MATTERSON seconded the motion, which was passed without discussion.

AT a meeting of the Birmingham Amalgamated Society of Gas Workers last Sunday week, it was stated that 260 men had been enrolled as members.

THE WATER GAS SYNDICATE.

The following article, by a gentleman well known in the gas world, appeared in a recent issue of the *Iron and Coal Trades Review* :—

The speech of Mr. Samson Fox, Chairman of the Water Gas Syndicate [see *ante*, p. 959] is remarkable for what it does and what it does not say, and is a striking example of the kind of thing that goes down with the public as science. We will not go into the metallurgical operations which he describes, or their economy, but will confine our remarks to what is said of the heating power of the water gas, in which he displays an amount of ignorance rarely equalled by our popular expositors of science, and an amount of forgetfulness of his own statements which is marvellous. First, he alleges that while coal gas requires for its perfect combustion 10,000 cubic feet of air for each 1000 feet of gas, water gas requires only 2000 cubic feet of air for the same quantity, and thus "robs" the air of the room of only one-fifth of the quantity of air required by the former. If Mr. Fox knows anything of the laws of combustion on which he discourses, he must know that "the quantity of heat produced by the combustion of any gas is directly proportioned to the quantity of oxygen or of air which is required for its combustion," and that, therefore, water gas, in the above statement, has only one-fifth of the heating power of coal gas. Even if we admit the much-repeated 4d. per 1000 cubic feet, we must multiply this by 5 and we get 20d., or about double what coal gas delivered into the gasholder costs many gas companies. And notwithstanding this small quantity of air required for the consumption of water gas, Mr. Fox, in another part of his speech, says that from one ton of coal we get only 10,000 cubic feet of coal gas, while the same ton of coal will give "35,000 feet of water gas of a very much higher heating power."

We would wish to refer Mr. Fox to a pamphlet written by his own Engineer, and sent into circulation by his own Company, in which it is stated that ordinary coal gas gives 150 per cent. more heat than water gas. We trust that Mr. A. Wilson was not at the meeting, and did not sit by in silence when the astonishing statement was made that water gas had a much higher heating power than coal gas. We suppose Mr. Wilson's statement of the relative heating power of the two gases is nearer the truth than Mr. Fox's, which, if true, would show coal gas to be 400 per cent. more efficient for heating than water gas.

After such a display of ignorance and want of memory, we thought that we could not be surprised at anything; but we confess we opened our eyes wider than before when we came to the statement that, instead of a 36-inch main necessary for coal gas, a main of 1¼-inch diameter would be enough for water gas. Now, taking Mr. Wilson's estimate of heating power, we should require a main 150 per cent. larger. The square of 36 is about 1300, and this multiplied by 2½ is 3250 inches; but by a process not yet explained, Mr. Fox can get a main to do the same work with an area of about 1½ inches, or about the 2200th part of the area, without counting the friction which diminishes enormously the efficiency of small pipes. We should like to get from Mr. Fox a statement of the quantity of water gas delivered at the end of a mile of 1¼-inch main; a statement of the initial and final pressure; return of the leakage; an account of the consequences which would follow from the bursting of such a main, which carried as much gas as a 36-inch main; and a calculation of the heat generated and power required to drive (say) 20,000 cubic feet of gas an hour through this "pipe stem." He can learn something on these subjects from the Popp Compressed Air Company of Paris, which feels it necessary to charge a very high price per horse power for air which has again to be heated by the consumer.

Finally, Mr. Fox has *not* said this: What is there to prevent any other company or individual from making water gas, without contributing one penny of the £1,654,000 tax which he says they have already levied for the partial use of patents, some of them just expiring, some of them of very doubtful validity, and probably all of them of the same commercial value as the electric light patents, in which not long since the ignorant public launched millions, and for which they got no return. We believe the whole of the electric light companies in the kingdom did not honestly earn 1s. per cent. on their joint capitals.

STAFFORD CORPORATION GAS SUPPLY.

THE PROGRESS OF THE GAS UNDERTAKING IN THE PAST YEAR.

At the last Meeting of the Stafford Town Council—the MAYOR (Alderman Mycock) in the chair—a letter was received from the Chairman of the Gas Committee (Alderman Dudley), announcing his intention to relinquish his municipal duties, owing to the "organized obstruction and annoyance" to which he had for some time been subjected "at the hands of a very small section of the Council." Alderman Dudley was Chairman of the Library as well as of the Gas Committee; and it was in respect of the former capacity that the trouble arose which caused him to send in his resignation. His letter was accompanied by the following statement, showing the result of the working of the Corporation gas undertaking for the year ending March 25 last:—"The gas sold has been 90,141,000 cubic feet; being an increase of 3·03 per cent. over the preceding year. The total expenses of manufacture have been £6224 11s. 9d.; being a decrease of £135 18s. 4d. The total expenses of distribution of the gas have been £485 14s. 1d.; being a decrease of £34 3s. 10d. I desire the Council to take note of the fact that while there has been an increase of 2,649,000 cubic feet of gas made, producing £401 3s. 10d., it has been accomplished at a less cost by £170 2s. 2d. The amount paid for rates during the year has been £746 2s. 2d.; showing the very serious increase of £150 9s. 1d. over the preceding year. Owing to the reduction in the rents of meters during the past year, the income from this source shows a reduction of £96 10s. 8d. The income from residual products shows a sensible increase—viz., coke, £186 2s. 11d.; tar, £100 10s. 11d.; sulphate, £121 6s. 2d.; making a total of £408. The manufacture of sulphate continues to be attended with the most satisfactory results. The quality made shows an increase of 6 per cent.; and the expenses attending the manufacture, a decrease of 5 per cent. The total receipts for the year amount to £15,509 13s. 6d.; and the expenditure to £8892 5s. 4d.—leaving a balance of gross profit of £6617 8s. 2d. To this must be added £5 6s. 1d., the balance of undivided profit from last year; making a total of £6622 14s. 3d. Out of this there has been paid £151 19s. 6d. for income-tax, £3060 6s. 1d. for interest on borrowed capital, and £1391 12s. 6d. instalment of loan repaid to the Alliance Insurance Company; leaving a balance of £2018 16s. 2d., or an increase of £663 10s. 1d. over last year. It is proposed that £1500 be handed over to the general district fund, towards the reduction of the rates for the coming year; that £500 be placed to reserve, making this fund £2000; and that the balance of £18 16s. 2d. be carried forward. This payment makes a total of £16,100 handed over to the funds of the borough since the works were acquired by the Corporation; in addition thereto the capital has been reduced by £12,062 15s. 11d. It is proposed to reduce the charge for lighting the public lamps from £3 8s. 6d. to £3 3s. per lamp, less 5 per cent., which will benefit the ratepayers to the extent of about £90 per annum. The question of a reduction in the price of gas is one deserving the serious consideration of the Council, especially in the face of an appropriation of £2000, in addition to the large repayment of capital obligations; for I entertain a decided opinion that the lower the price is reduced, consistent with good business, the greater will be the consumption of gas for lighting, heating, and motive power, in addition to being prepared to meet the growing competition of other illuminants. The accounts have been carefully prepared and certified as correct by the Auditors; and it is very satisfactory to me to be able to assure the Council that the stocks have been taken most liberally, and represent a much higher monetary value than appears in the books. I cannot close this report without expressing my acknowledgments to the members of this Committee for the uniform support they have given me during the six years I have presided over this department. The good feeling that has always existed between them, the management, and myself has undoubtedly been a factor in its prosperity. To the Manager, Mr. J. Ferguson Bell, my thanks are specially due, for the assistance and co-operation he has invariably given me. Having been in constant communication with him, I am able to recognize his great ability and integrity in the carrying out of every detail of this department; and in him the Corporation has a most valuable public servant."

The following is Mr. Bell's analysis of the accounts :—

Capital—	
Gas Company's debenture bonds	£4,983 6 8
Corporation loan on mortgage	42,927 4 1
Do. on debentures	13,450 0 0
Perpetual annuities	14,150 0 0
	£75,530 10 9
Or at the rate of £8 6s. 7d. per ton of coal carbonized, and 18s. per 1000 cubic feet of gas sold.	
Amount expended on fixed plant account	£85,690 10 1
Less amount written off	12,062 15 11
	£73,627 14 2

Coal carbonized		9,065 tons.
Gas made		90,190,000 cub. ft.
Do. sold	83,667,000 cub. ft.	
Do. used at the offices and works	901,000 "	
Leakage, &c.	5,583,000 "	
		90,141,000 cub. ft.
Average illuminating power of gas supplied		16·82 spm. cndls.
Gas made per ton of coal carbonized		9,949 cub. ft.
Do. sold " "		9,238 "
Do. per cent. on make		92·8 per cent.
Do. used at offices and works, per cent. on make		1·0 "
Do. unaccounted for " "		6·2 "
Coke made (estimated)		5,892 tons.
Do. per ton of coal carbonized		13 cwt.
Do. used for fuel, per cent. on make		37 per cent.
Average price of coke sold (less expenses)		6s. 5d. per ton.
Tar made		492 tons.
Do. per ton of coal carbonized		11·3 gals.
Average price of tar sold		19s. 4d. per ton.
Ammonium sulphate made		106½ tons.
Do. do. per ton of coal carbonized		26·2 lbs.
Average price of ammonium sulphate sold (less expenses in manufacture)		£8
Net proceeds of residuals per cent. on cost of coal		65 per cent.

	£ s. d.	£ s. d.	Per Ton of Coal Carbonized. s. d.	s. d.	Per 1000 cub. ft. of Gas Sold. d.	d.
Coal	—	3,879 16 2		8 6·72		11·13
Less residuals—						
Coke	1,197 9 2		2 7·70		3·44	
Tar	476 12 11		1 0·63		1·37	
Sulphate of ammonia	849 1 2		1 10·48		2·43	
		2,523 3 3		5 6·80		7.24
Net for coal	—	1,356 12 11		2 11·92		3·89
Manufacture—						
Purifying	138 9 4		0 3·67		0·40	
Salary of Engineer	291 13 4		0 7·72		0·84	
Wages for carbonizing	820 11 10		1 9·72		2·35	
Repairs and maintenance of works	1,036 18 5		2 3·45		2·97	
		2,287 12 11		5 0·56		6·56
Distribution—						
Salaries	190 0 0		0 5·03		0·55	
Repairs & maintenance of mains and services	49 18 11		0 1·32		0·14	
Repairing, renewing, and refixing meters	245 15 2		0 6·51		0·71	
Public lamps—Lighting, cleaning, repairing, &c.	276 17 3		0 7·33		0·79	
		762 11 4		1 8·19		2·19
Rates and taxes	—	746 2 8		1 7·75		2·14
Management	—	236 5 7		0 6·25		0·68
Bad debts	—	66 14 0		0 1·77		0·19
Depreciation fund	—	856 0 0		1 10·67		2·46
Total working expenses	—	4,955 6 6		10 11·19		14·22
Coal and working expenses, less residuals	—	6,311 19 5		13 11·11		18·11
Sale of gas	12,440 6 0		27 5·36		35·69	
Rental of meters	369 16 11		0 9·79		1·06	
		12,810 2 11		28 3·15		36·75
Profit on gas	—	6,498 3 6		14 4·04		18·64
Add miscellaneous receipts—						
Rents	17 12 0		0 0·46		0·05	
Profit on gas-fittings	101 12 8		0 2·69		0·29	
		119 4 8		0 3·15		0·34
Gross profit		6,617 8 2		14 7·19		18·98
Income-tax	151 19 6		0 4·02		0·43	
Interest on capital	3,060 6 1		6 9·02		8·78	
		3,212 5 7		7 1·04		9·21
		3,405 2 7		7 6·15		9·77
Reserve Fund	—	500 0 0		1 1·24		1·43
Sinking fund account	—	1,991 12 6		3 0·84		3·99
Net profit	—	1,513 10 1		3 4·07		4·35
Add last year's balance	—	5 6 1		0·14		0·01
		1,518 16 2		3 4·21		4·36
Less amount transferred to general district fund	—	1,500 0 0		3 3·71		4·30
Balance	—	18 16 2		0 0·50		0·06

Alderman PEACH, in moving the adoption of the report, expressed his regret that Alderman Dudley, in his communication, had introduced matter with regard to the price of gas, because at the Committee meeting he had been in a minority of one when the question was considered. They were now in a position to sign a contract for 4000 tons of coal at an advance of 1s. a ton, and a further increase of 4 per cent. a ton for every increase of 5 per cent. that might take place in miners' wages. By this

arrangement they would buy their coal at considerable disadvantage. He was opposed to any reduction in the price of gas in the face of a greatly rising market for coal, as this might lead to a deficit in place of the profit of more than £2000 last year.

The report was adopted.

THE PROPOSED AMALGAMATION OF MANCHESTER AND SALFORD.

One of the Salford newspapers published a few weeks ago a summary of the report which has been drawn up by a Committee of the Corporation, in reply to the proposals which have been made for the amalgamation of Salford with Manchester. The Committee, which has been investigating the matter since Dec. 5, state that they have carefully studied the report of the Manchester and Salford Association for the Consideration of the Amalgamation of Manchester and Salford,* and have also carried on an investigation into the status of Manchester and Salford municipally, as to the administration of finance and rating.

Setting out with the declaration that they do not concur in the deductions and conclusions drawn from the published accounts of the Corporations, they proceed to deny the accuracy of the method adopted in arriving at the assets of the two towns. In the Association's report, the total sums representing the assets are, say the Committee, set out, and are followed by a theory of computation which assumes that the figures stated are convertible into cash; whereas the doctrine of assets is that the asset is worth precisely so much as, and no more than, it would realize if saleable, or, if a trading asset, just what it earns if profitable. "Municipal assets mainly consist of buildings and the like, which cannot be sold, and plant for gas and water, which may or may not be a source of profitable revenue, irrespective of the figure at which the concern may stand as an asset." Having established this preliminary point, the Committee state that the water system of Manchester has grown enormously of late, and the expenditure become proportionately great. The surplus revenue of past years has thus disappeared, and the income barely does more than balance the account; while on gas account there was a deficit of more than £27,900 at March last year. In face of this state of things, they ridicule the statement that "the loss to Manchester on amalgamation, on capital account, would be 3s. 8d. and 0·1d. in the pound, and the gain to Salford 11s. 9d. and 0·3d. in the pound." Salford would not only not benefit by the transaction, but would become responsible for a large share of the formidable indebtedness which the assets represent. A point is made of the fact that the Manchester Town Hall, which is put down as an asset of £1,047,580 (including £201,926 for interest during construction), would be of no value to Salford, though the town would be liable to contribute its proportion of the £40,062 annually paid on account of this asset. Exception is also taken to the mode adopted in valuing the assets; those of Manchester being in some cases so treated as to show an increase on both the capital and the interest, while those of Salford stand at their depreciated amounts.

Proceeding to Part II. of the Association report, the Salford Committee observe that the difficulty of the rating problem has been intensified by the device of taking a former year's rate in Manchester and Salford, levied two years before the inquiry was commenced; the Manchester rates being, in fact, nearly 4d. in the pound higher than those quoted. The question of the water supply also comes under this head. On this subject the Committee remark: "It is affirmed that the net cost to Manchester of all the water consumed is 6·59d. per 1000 gallons; and that therefore the loss on the statutory supply to Salford of 2,000,000 gallons per day is 3½d. per 1000 gallons. This statement requires considerable elucidation; seeing that Manchester is at the present time supplying millions of gallons of water to her largest consumers at 4·85d. per 1000 gallons! It is gratuitous for the Association to assume that the large expenditure to be incurred by Manchester in the Thirlmere scheme is due in any way to Salford. The arrangements for the water supply to Salford was agreed upon in 1847, when an open supply was guaranteed to her for all time, on condition that she relinquished her share in a scheme then on foot, providing for an independent supply of water to Salford, and which had been embodied in a Bill laid before Parliament. The price she paid, therefore, was not for a bargain, but a guarantee for her future supply, at 3d. per 1000 gallons. This Salford did; and the application of Manchester to supply her with water—not to be endangered in any way in quantity or price by any extensions or speculative schemes of the city—became supreme. However, the Salford district did not oppose the Thirlmere project; being assured she had nothing to lose, but much to gain, by the enterprise. And in like manner, she has not protested against any expansion of the water system for the benefit of the city, in the profits of which she did not participate, and in the losses of which, if any, she did not expect to share." A statement as to the excessive cost of the working of the tramways in Salford is also denied.

Coming to Section III. of the report, which treats of "probable expenditure," the Salford Committee observe that, though under this head £500,000 is set down for new sewage works, and £15,000 for a new park, nothing is put down on account of Thirlmere, notwithstanding that the Accountant's figures show that the estimated expenditure on the work is £2,237,000, and that it is admitted that the additional rate in respect of this scheme will be 8·8d. in the pound. A quotation from a pamphlet published by Mr. Alderman King in opposition to the Thirlmere scheme is not unnaturally used in enforcing the Salford argument on this point. In regard to Part IV., "the question of rating," observe the Committee, "is again referred to, in its incidence on the district rates in particular. The fallacy of assets is once more introduced, as affecting the question of rating; and, in like manner, the gains and losses on the calculations as set out are valueless, if regarded as indicating a true estimate of the rating capacities of the city and borough." "Under Part V. the financial and other aspects of the foregoing sections appear to be reviewed; but your Committee dissent from most of the conclusions arrived at by the Association. The statement, for example, that 'Salford would have the advantage under amalgamation of lower rates than she has had for many years past, with the additional benefit of cheaper gas,' appears to your Committee to be characterized by a recklessness of assertion which is little less than culpable."

With reference to the contention that it is "absolutely necessary" to have one sanitary authority capable of dealing with the complete question of sewage, river pollution, floods, unhealthy dwellings, impure atmosphere, infectious diseases, &c., the Committee contend that Salford has dealt fairly with these matters; while the city has signally failed in her duty. "The reward of Salford is in a diminished death-rate, while Manchester, unfortunately, in her high death-rate testifies to the inactivity displayed, in respect to interception and treatment of sewage, the pestilent condition of the river, and it may be, of other sanitary matters."

Certain presumed commercial advantages which would accrue to Salford from amalgamation, are rather contemptuously dismissed, and as little regard is paid to "the moral and intellectual welfare" argument of the Amalgamation Association. Even if amalgamation were thought advisable, the Committee fear that the result would be such an increase in the members of the City Council as to render that body unwieldy. "When it is remembered that it is proposed to incorporate with the city the out-districts of Crumpsall, Blackley, Gorton, Openshaw, Newton Heath, and Moss Side, which will severally require to be represented, it is conceivable that the total number of members of the Manchester Council will be so much increased that the voice of Salford, through her representatives, would not be very effectively heard. Moreover, the time for the consideration of the business, augmented by the addition of so many new interests, would be so protracted that it is difficult to foresee how any adequate discussion could be had in relation thereto."

Finally, the Committee say that, after carefully considering the report of the Association, they do not regard it as exhibiting a legitimate basis upon which a just estimate can be formed on the question of amalgamation. The contention by the Association, that administration would be less costly, sanitary reform accelerated, the commercial and industrial affairs of Salford improved, and the general welfare of the borough materially advanced by amalgamation, are mere conjectures unsupported by evidence, and not likely to be realized. The contiguity of the two places does not, in itself, constitute a valid reason for amalgamation; but, on the contrary, having regard to the prospective increase of the population, it furnishes a strong argument against it. The statement that "no material sacrifice of a financial character" would be made, so far as that may apply to Salford, is not, they say, in accordance with the facts. The outcome of the investigations into the financial position of Salford and Manchester has shown to the Committee that, not only would Salford be called upon to make very material sacrifices, but that amalgamation would be entirely fatal to her assured prospect of diminished rates. "Your Committee, therefore, in conclusion, submit their report to the Council, with the expression of their opinion that the municipal interests of Salford would be detrimentally affected by amalgamation with the city in representation, in administration and finance, and in the prospective development of her resources as a municipality; and this not only in the increased commercial prosperity which awaits her people on the completion of the Ship Canal and the advent of the trading interests contingent thereon, but also in the continued enjoyment of effective local self-government controlled by her own representatives, having augmented municipal administration under her powers as a County Borough Council."

Appended to the report are voluminous preliminary reports of various Sub-Committees. The following extracts from the report of the financial Sub-Committee, giving the results of their investigations, are worth reproducing, inasmuch as they deal concisely with what after all is the most practical portion of the question at issue:—"That the 'excess of assets' of Manchester as compared with Salford and set out in the report of the Association is inaccurate, and that the benefit arising from such excess is not borne out by a corresponding relief in taxation. That the rate of requirements for municipal purposes have for years been regular; that the present net rate is higher in Manchester than in Salford; that in Manchester the rates have risen considerably, and must certainly increase to meet the interest, redemption, and maintenance charges of the sewage scheme, the increasing sinking fund contributions, and the probable charge of part of the Thirlmere undertaking. That Salford rates are reduced this year, and are on the decline. That the rateable value of the borough has increased very rapidly of late; and a larger increase is certain from the Ship Canal docks and contingent works. Further, that the main arterial roads are completed in the district of the unbuilt area, allowing for a much larger development of rateable value at a minimum charge to the rates. That the Salford gas charges are now less than in Manchester. That at March, 1888, there was a deficit on the Manchester gas revenue account of £27,931. That the borough as a whole would receive no advantage in water charges by amalgamation. That the average rate of interest on indebtedness (1888) in Salford is £3 10s. 6d. per cent., and the total indebtedness £1,565,245; that the average rate of interest in Manchester (mortgages, consolidated stock, and annuities combined) is £3 15s. 11½d. per cent.—or a higher average charge than in Salford of 5s. 5½d. per cent. on a total indebtedness of £7,094,217, of which no less an amount than £3,775,735 is consolidated stock at 4 per cent. permanently. That the Salford sewage works are in operation; whilst the Manchester sewage scheme has yet to be carried out. That the proposed amalgamation is only partial, having reference to municipal administration only. That the differential and unfair rating in the various townships would continue under amalgamation, as it exists at present in the eleven rating townships, by the heterogeneous system of Manchester. That the suggested amalgamation would create too large and centralized an authority, and would prevent the proper local supervision so essential to economical municipal government. Your Sub-Committee believe, after a careful and unbiassed consideration of the report, that the borough of Salford . . . . would, as a whole, if it were to amalgamate with Manchester, materially lose so far as the financial aspect of the question is concerned."

* A summary of this report appeared in the JOURNAL, Vol. LII., p. 729.

THE OKEHAMPTON GAS COMPANY AND THE ELECTRIC LIGHT COMPETITION.—The Directors of the Okehampton Gas Company have issued their annual report, from which it appears that the gas and meter rental for the last financial year amounted to £451—a decrease of about £30 on the previous year; the falling off occurring in the quarter when the electric light was being used in the town. The coke, tar, &c., realized £91. In view of the actual and possible competition in the lighting, the Directors reduced the price of gas to 4s. 2d. per 1000 cubic feet at Christmas. The loss of income by this reduction and the withdrawal of customers will, it is estimated, exceed £150 per annum. At a recent meeting of shareholders, the position of the Company was considered, and the advisability of adopting measures for supplying electric light as well as gas was discussed, but no decision was arrived at. A dividend of 5s. per share and a bonus are recommended for payment; but a similar distribution cannot, the Directors state, be expected to be made another year.

HASTINGS ELECTRIC LIGHT COMPANY.—The report presented at the annual meeting of the Hastings Electric Lighting Company last Wednesday shows a slight improvement in the results of the working during the year ending March 31, compared with the previous twelve months. The demand for incandescent lighting increases; the Company now supplying 984 lights, as against 864 in the previous year. The Directors believe that an enormous increase could be made at once if sufficient capital were available for laying down new mains; and they are not without hope that arrangements may be made by which public and private lighting by electricity may be vastly extended. There was a profit on revenue account of £432 2s. 10d.; and after paying the interest due to the bankers and to the debenture bondholders, a net profit was left of £178 2s., which, added to £103 19s. brought forward from the last accounts, makes the sum of £287 available for dividend, out of which the Directors proposed to pay 5 per cent. free of income-tax. In moving the adoption of the report, the Chairman (Mr. H. M. Baker, J.P.) referred to the difficulty they had in raising fresh capital. If they had sufficient capital to develop it, they could, he said, double the present business. The report was adopted.

METROPOLIS WATER SUPPLY.

The Proposed Amendment of the Metropolitan Water Acts.

Early in the present session (see *ante*, p. 392,) a Bill was introduced into the House of Commons, by Mr. Fenton and other Metropolitan members, for the purpose of amending the Acts relating to the water supply of London. After considerable delay, the Bill has been printed. The preamble recites that under sections 23 and 25 of the Metropolis Water Act, 1852, and section 32 of the Act of 1871, wide powers have been conferred on the Companies which supply the Metropolis with water, of cutting off the water, and that similar powers are contained in the Special Acts of the Companies and the Acts incorporated therewith. It then goes on to state that it is desirable, for sanitary and other reasons, that this power of the Companies should be restricted. The Bill consists of only five clauses, the last two of which are as follows: "Notwithstanding anything in sections 23 and 25 of the Metropolis Water Act, 1852, or in section 32 of the Metropolis Water Act, 1871, or in any Special Act of any company, or in any Act incorporated therewith, it shall not be lawful, in any of the cases mentioned in any of these sections, for any company to cut off any pipe through which water for domestic purposes is supplied to any premises, except under the authority of an order of a Court of summary jurisdiction, which order any such Court is hereby empowered to make, subject as hereinafter provided." "Before making such order, the Court shall be satisfied that sufficient notice has been given by the company to the person supplied with water to have enabled him to meet the requirements of the company, and shall be further of opinion that, under all the circumstances of the case, it is just and reasonable to make the order."

The London County Council and the Water Undertakings.

At the Meeting of the London County Council last Tuesday, the report of the Special Committee on Water Supply, which was presented at the meeting of the Council on the 16th ult., and the consideration of which was deferred till after the Easter recess, was again brought forward by the Chairman (Mr. J. Beal), and agreed to without discussion. It will be remembered that the Committee passed the following resolution:—"That it be reported to the Council that, as the Committee are advised by the Solicitor that the Council has no power to incur any expense in connection with any inquiry as to the matter referred to them, the Committee are of opinion that such inquiry must not be entered upon until the Council has obtained from Parliament power to incur the expenditure necessary in making such inquiry." The Committee stated that they proposed to prepare a short digest of the information on the subject contained in the various parliamentary papers.

The Quality of the Water in April.

Messrs. Crookes, Odling, and Tidy, in the course of their report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the daily samples taken of the water supplied to London during the past month, say: "The quality of the water supply has continued throughout the month to be entirely satisfactory. Its composition has not been found to differ, to any noteworthy extent, from that observed to prevail during the first three months of the year; but the slight variation that has been recognized is in the direction of an increased degree of freedom from organic matter. Thus, in the case of the Thames-derived samples examined during the month, the mean proportion of organic carbon was found to be 0·154 part in 100,000 parts of the water, as against a mean of 0·065 part furnished by the previous three months' supply. The maximum proportion of organic carbon met with in any single sample of Thames-derived water examined during the month was found to be 0·170 part in 100,000 parts of the water. The difference in mean composition of the Thames-derived water, as supplied by the different Companies, was, as usual, wholly insignificant. This, our hundredth monthly report, completes the record of the results of our examination of over 18,000 samples of the water supply of the Metropolis."

Castleford Local Board Water Supply.—For some time past the Castleford Local Board have been in search of a fresh supply of water; and among others the Wakefield Corporation have been applied to. Last Friday week a special meeting of the Board was held to receive the report of a deputation to the Wakefield Water Committee. After the report had been discussed, a resolution was adopted to the effect that the Board accepted the offer of the Committee of the Wakefield Corporation to supply the township with water for a period of 30 years at the rate of 8d. per 1000 gallons up to 150,000 gallons per day; and when the consumption exceeded that, the price to be 7½d. per 1000 gallons on all consumed —the maximum to be 250,000 and the minimum 125,000 gallons. Pending this the Local Board to be at liberty to take water from the mains of the Whitwood Local Board at 7d. per 1000 gallons for all consumed. The Board desire liberty to sell water to adjoining smaller districts.

Monte Video Gas Company, Limited.—The Directors' report for the year ending Dec. 31 last, to be submitted at the annual meeting of this Company next Friday, states that the net profit for the twelve months is £40,853. From the profit and loss account provision has been made for income-tax, bad and doubtful debts, and depreciation of furniture and sundry capital accounts; the sum of £5000 has been transferred to reserve, increasing it to £65,000; and £1000 has been placed to insurance account, which now amounts to £10,000. The balance then remaining at the credit of profit and loss available for dividend is £34,416. Of this the Directors paid on Nov. 30 last an interim dividend of 12s. per share, free of income-tax, in respect of the half year ended June 30; and they now recommend the payment of a similar amount—making together a dividend of 6 per cent. for the year. This will absorb £32,515, and leave a balance of £1901 to be carried forward. The private consumption of gas, it is stated, continued to increase during the year in a very satisfactory manner, due in a great measure no doubt to the large reduction in price which was made from April 1, 1887; so that 1888 was the first year in which the effect of the reduction was fully felt. This large increase in consumption has made it imperative that further storeage capacity should be provided without delay; and the Directors have therefore contracted with a well-known English firm for the erection of a new tank and gasholder, which, it is expected, will be ready for use by the end of the present year. It has also been found necessary to largely extend the present system of mains. The whole of these works are being carried out under the advice of Mr. John Ohren, C.E., the Company's new Manager at Monte Video, who took up his duties in January, 1888; and when completed the Directors have no doubt they will lead to a large increase in the business of the Company. The contract with the Municipality of Monte Video for the public lighting of the city, which expired in March, 1887, is still un-renewed; but the Company nevertheless have regularly continued the public lighting as before. The sums due to the Company for Government and municipal accounts amounted on Dec. 31 last to £37,198. Since that date, however, the Company have received from the Government bonds in settlement of the greater part of that debt.

NOTES FROM SCOTLAND.

(from our Edinburgh correspondent.)

Edinburgh, *Saturday*.

The settlement of the contract for the residuals produced at the Arbroath Corporation Gas-Works has proved quite a bitter affair. I stated last week the recommendation of the Committee of Management to accept the offer of Messrs. Dobbie and Co., of Leith, to give 6s. per 100 gallons, and to erect works for the treatment of the products in the town, if they obtained a five years' contract. A meeting of the Council was held last Monday, at which Provost Anderson read a letter from the present holder of the contract—Mr. W. Briggs, a local man—giving it as his opinion that it was illegal for the Corporation to ask offers for one year, and to let the contract for five years, and reminding the Corporation that he had taken the contract at times when no other firm would tender for the products. The Provost moved that the resolution of the Committee be rescinded. As a way out of the difficulty, the Corporation, by the casting vote of the Provost, resolved to ask the offerers to tender anew. This displeased the members who supported the Committee; and, upon their requisition, another meeting of the Corporation was held on Wednesday, at which, after a long and sometimes warm discussion, the original resolution to let the contract to Messrs Dobbie and Co. was carried. The desire of the Committe was apparently to let the firm have he residuals who offered most for them; and, on the other side, there was a feeling that the present contractor, who claimed to have befriended the Corporation should be continued. There can be no doubt that the Committee were right in their guiding principle, but that they erred in accepting an offer different from what they advertised for. It would have been better to have given the other offerers an opportunity of amending their tenders before deciding upon one. But if the Committee went wrong in that particular, the same may be said of the other party, who, after Monday's meeting, requested amended offers from the other four. Only one responded to their appeal; and this was Mr. Briggs, who offered to give 6s. 6d. per 100 gallons for one year, and 6s. 2d. for the succeeding four years. It thus happened that, through a slight irregularity, the supporters of the old contractor, procured what they wanted. Why they did not accept his amended offer, I cannot say, unless light be thrown upon it by the remark of Mr. Michie, that Mr. Briggs had complained of the high price of his contract, and had obtained hundreds of pounds back. The Corporation seem to delight in working at sixes and sevens —not a very commendable spirit, and one which, as in this instance, gives them more trouble than they need have in the transaction of their business. Their animosities seem to extend to the community; for it is announced that a firm of solicitors have been instructed by a number of ratepayers to have the Corporation interdicted from carrying out their resolution, on the ground of the alleged illegality of accepting a five years' contract. If such a movement be taken, it is not likely to be of much effect, because the errors which I have referred to, on both sides, were more in a nature of indiscretions as a matter of policy than positive illegalities.

The litigation which I mentioned some time ago as threatened over the negotiations for the transfer of the St. Andrews Gas Company's property to the Town Council, and which I thought was obviated by compromise, it seems is to go on. On Tuesday Lord Wellwood in the Court of Session closed the record in an action in which Provost Paterson and three others, as Directors of the Company, seek to interdict Andrew Aikman, sen., and four others, the remaining members of the directorate, and Mr. Jesse Hall, the Manager and Secretary, from refusing access to the books of the Company. The complaint is that last autumn Mr. Hall refused to allow the Provost to copy the list of shareholders. The respondents say the Provost required the list in the interest of the Town Council, who are offering a most inadequate and unfair price for the Company's undertaking; and it is maintained that, in refusing the list of shareholders, Mr. Hall was acting in the interests of the Company. They also add that at a meeting on the 27th of March, at which 266 out of 395 shares were represented, a resolution was adopted, calling upon the Provost to resign his office of Director, as his actions were at variance with the interests of the Company, and he had thereby forfeited their confidence.

The members of the Gas Committee of Aberdeen Town Council on Tuesday went through the annual formality, for it is nothing else, of visiting the gas-works. The Manager (Mr. A. Smith) showed them round the works, and took advantage of the opportunity of having all his Committee present, to explain to them the manner in which he proposed to work the stoking machinery which he is at present asking the Council to furnish. Everything was found to be in good order; and before leaving, the Lord Provost thanked Mr. Smith for his explanations.

An action has been brought before Lord Kinnear in the Court of Session, in which John Mackay, Contractor, of Edinburgh, sues the Police Commissioners of Dunbar for £334—the balance of the contract price of £1630 for the extension of the water-works. It is pleaded in defence that the works have not been satisfactorily completed—a heavy leak having already occurred; and that, in respect of these and other circumstances, nothing is due to the Contractor.

(from our Glasgow correspondent.)

Glasgow, *Saturday*.

I have been informed that the increased price to be paid for the residual products at the Tradeston Gas-Works for the period of five years just commenced will be at the rate of something like £9000 per annum. The amount for carriage to be paid to the Caledonian Railway Company will probably be not less than £4000 a year. The contract, it may perhaps be remembered, has been let to Messrs. J. Ross and Co., tar distillers, of Falkirk. Previously it was taken for many years by the Alum and Ammonia Company, whose works are only separated from the gas-works by the breadth of a street. In the tenders recently submitted, they showed a disposition to increase their price very considerably, but not to anything like the extent made by the Falkirk firm.

At the last meeting of the Port-Glasgow Town Council, a report was submitted from the Gas Manager (Mr. J. M'Cubbin), which he had been asked to prepare in reference to the new system of lighting and extinguishing the lights on the common stairs. He said he had found the system to work very well, and considered that it would result in a large saving of gas during the ensuing year if the Commissioners should think fit to continue it. He also remarked that the decrease in the make of gas for last month was largely due to the burners being reduced and being lighted and extinguished regularly by the lamplighters. There had been some difficulty in keeping the regular burners in the stair lights, as there was a disposition on the part of the tenants to remove them and substitute larger ones instead; but whenever this had been done, he had had them replaced by the regulation burners. Certain alterations would require to be made with some of the stair lamps, so as to make them more accessible for the lamplighters; but as the alterations were of small account, he could undertake to carry them out during the summer months. It was agreed that this matter should be taken into consideration by the Gas Committee at a future meeting, before the period of relighting the lamps and stair lights arrives. I may here remark that the quantity of gas made

at Port-Glasgow from May 15, 1888, to April 30 last was 22,409,500 cubic feet, as against 21,627,800 feet during the corresponding portion of the preceding financial year.

The following is a summary of the speech referred to in my "Notes" last week as having been delivered at the opening of the gas exhibition in Stirling by Dr. Galbraith, Chairman of the Stirling Gas Company:—He said that when he was asked to perform this duty, it seemed to him at first that some one else might have been chosen for the office, some one not apparently so directly connected with gas companies as he was, being Chairman of the Stirling Gaslight Company, because if the enterprise of the Messrs. Chisholm (the organizers of the exhibition) was successful, it would no doubt increase the revenue of the Company, and he might be supposed to be advocating as an interested party the adoption of the system which they were bringing under public notice. Then he reflected that if the revenue of the Company was increased by the public taking advantage of the various appliances for cooking, heating, and lighting, the benefit would not fall so much upon the Directors of the Company as upon the general public. The Directors had always kept the dividends of the Company within extremely reasonable limits; and rather than make large profits, they gave the public the benefit by reducing the price of gas. If, therefore, the exhibition was successful, as he hoped it might be, the public would derive a benefit in a material decrease in the price of gas. The system of supplying apparatus for heating and cooking by gas was extensively adopted in some of the larger cities and towns in the kingdom; and the gas companies, or those who had the supplying of gas, provided, for certain charges, the necessary apparatus. The question had not been overlooked by the Stirling Gas Company, as might have been supposed; but for certain reasons, which seemed to them quite satisfactory, they did not think it would benefit them to enter upon that line of business. At the same time they were in perfect sympathy with the gentlemen who had initiated the exhibition, and who were going to enter upon the business of supplying stoves, and hoped they would meet with every success. There were two or three different kinds of gas application brought before them in the exhibition. In the first place, there was an improved method of lighting, whereby it was professed to give a much greater illuminating power, by their improved apparatus, with no larger consumption of gas than ordinary. Then, again, there was the question of heating apartments by gas-fires. During the last year gas-fires had been introduced into a great many houses with very satisfactory results. Not the least important portions of the display in the hall were the gas cookers, which were also, in certain circumstances, extremely useful, efficient, and economical, and possessed distinct advantages over an open gas or coal fire. After some further remarks, the Chairman concluded by saying that he had no doubt that all would agree with him when he remarked that the public of Stirling were greatly indebted to the Messrs. Chisholm for the enterprise which they had shown in getting up the gas exhibition, and in bringing together such an extensive collection of apparatus at the expenditure of no small amount of time, trouble, and, he believed, a large sum of money. On his motion, thanks were accorded to Messrs. Chisholm and Son.

Business was done last Monday in the Partick, Hillhead, and Maryhill Gas Company's stock at 97s. 6d. per share; and again at the same rate on Tuesday and Wednesday.

There has not been much business done this week in sulphate of ammonia; but the commodity continues very scarce on account of some large shipments taking place from Scotland. The price to-day may be stated at £11 17s. 6d. per ton f.o.b. at Leith, less 3¼ per cent. discount. It is said that the quotation has reached £12 this week; and that £11 15s. has been offered and declined for delivery up till March of next year.

The Glasgow iron market has been quiet this week, with no special feature. Scotch warrants have fluctuated in price between 43s. 8d. paid on Monday, and 43s. 3d. cash yesterday. There have also been fluctuations of about 4½d. per ton in the price of hematite pigs, and of 3d. per ton in the price of Cleveland iron. Scotch special brands have not been much in demand; but the prices have not changed during the week.

Business continues steady in the local coal trade. The settlement of the German strike has relieved the temporary tension that existed. A good average trade in the shipping department has been put through; and as the season for "nuts" is now on, these help to swell the total. An extra run upon dross has been a feature of the last few days; the price having at the same time advanced from 3d. to 6d. per ton for best qualities, making quotations from 3s. 3d. to 3s. 6d. at the pits.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 25.

Sulphate of Ammonia.—The demand is improving; and there are now buyers at £12 f.o.b. Hull, and £11 17s. 6d. f.o.b. Leith, for prompt and forward delivery. Some rather large contracts have been placed with German buyers; and there can be very little doubt that sulphate will be scarce, and consequently dear during the summer months. Speculative business for Spring, 1890, delivery is also reported, which indicates that consumers, recognizing the fallacy of regulating sulphate by nitrate values, have a good opinion of the market even so far ahead. Nitrate is worth only 8s. 4½d. to 8s. 6d. per cwt. for spot parcels and due cargoes; hence there exists a difference of about £3 10s. per ton, which is a rather wide margin. On the nitrogen basis, sulphate to-day costs 12s. per unit; while nitrate can be had at 10s. 9d. per unit.

LONDON, *May* 25.

Tar Products.—Benzols are distinctly sick; and there is no doubt about the indifference of buyers of this article. The production during the past season has been unusually large; and it is said that aniline makers have very heavy stocks. Fortunately the present make is small; and distillers would be wise to withhold offering in the meantime. Other products are in moderate demand. Prices: Tar, 20s. to 25s. per ton. Benzol, 90 per cent., 3s. 1d. per gallon; 50 per cent., 2s. 2d. per gallon. Toluol, 1s. 5d. per gallon. Solvent naphtha, 1s. 3d. per gallon. Crude naphtha (30 per cent.), 1s. 1d. per gallon. Light oil, 3½d. per gallon. Creosote, 2½d. per gallon. Pitch, 23s. 6d. per ton. Carbolic acid (crude), 3s. 9d. per gallon. Cresylic acid, 10d. per gallon. Tar salts, 17s. 6d. per ton. Anthracene (30 per cent.), "A" quality, 1s. 3½d. per unit; "B," 1s. 1d., according to quality.

Ammonia Products.—Sulphate is moving off more freely; and at the moment there is an excellent demand for it at slightly better prices. Cautious buyers have held aloof, expecting that the low price of nitrate would influence the value of sulphate. To show how illusory this is, it should be remembered that when nitrate got up to £11 per ton, sulphate was only about the same price, whilst its parity nitrogen-value should have made it worth £14. Prices: Gas liquor (5° Twaddel), 8s. per ton, with a rise or fall of 1s. 6d. per degree. Sulphate of ammonia, £11 17s. 6d. to £12 2s. 6d. per ton, according to position. Liquor ammonia, 2d. per lb. Carbonate of ammonia, from 3d. to 3½d. per lb. Muriate of ammonia, brown, £19 per ton; white, £23 15s. per ton. Sal-ammoniac, £90 to £92 per ton.

KEIGHLEY CORPORATION GAS SUPPLY.—At the monthly meeting of the Keighley Town Council last Tuesday, the Gas Committee recommended that tenders for coal for next year's supply to the extent of 16,000 tons be accepted. Alderman Brigg pointed out that the estimated consumption of coal for the present year, which had now nearly expired, was 18,500 tons; and next year it was calculated that an additional 900 tons, or, in round figures, 1000 tons, would be required, bringing up the total consumption for next year to 19,500 tons. Of this quantity about 3500 tons was to come in from old tenders, leaving 16,000 tons to be provided for, and for which tenders were now being accepted. He had also to state that there would be an increase in price, taking the average, of 1s. 8d. per ton. This would make a difference of £1625; so that the gas profits for the coming year would, he was afraid, be materially diminished, unless the Council were prepared to raise the price of gas. Alderman Holmes observed that the increased price of coal represented 2d. per 1000 cubic feet of gas. The Mayor said he believed the price of residuals was going up. Alderman Brigg replied in the affirmative; and he also thought there would be an increase in the consumption of gas. The recommendation was agreed to.

NORTHERN COAL TRADE.—Though there is not such an abnormal demand for coal from Germany as there was, a quantity of both coal and coke is still being sent to the German and Dutch ports, and this makes fuel scarce here and rather dearer. The demand for steam coal is strong; the price generally being about 10s. for best Northumbrian qualities, whilst in other instances a slight discount is allowed from the price. Small coal is 4s. per ton, free on board. The demand for gas coal is rather irregular, for the local consumption is about at its lowest, and there is less than usual being sent to London just now; but the exports are growing steadily. For manufacturing coal the demand is still large; and there is a fair inquiry for bunker coals for the use of steamships. Coke is quoted now at about 15s. per ton at the ovens for good qualities; but where a long time of delivery is needed the price varies. Gas coke is steady at old prices. The question of wages in the coal trade is now becoming pressing. The Northumbrian miners have asked for an addition of 10 per cent.; and though it is not believed that this will be entirely conceded, it is thought an advance of some moment will soon be given. The sliding scale which has long governed the wages of the miners in Durham will shortly cease to operate; and it is also certain that here, too, higher wages must be paid. When to this is added the fact that the cost of mining timber is much higher, there is the certainty of advances not only in the price of coals under sale, but also of advances of some moment in the prices under the contracts to be soon settled.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 988.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Apr.	10½	Alliance & Dublin 10 p. c.	10	18—19	−½	5 10 6
100,000	10	„	7½	Do. 7 p. c.	10	13—14	..	5 7 2
800,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	111—113	..	4 8 6
100,000	20	29 Nov.	10	Bahia, Limited	20	24—26	..	7 13 10
200,000	5	15 May	7½	Bombay, Limited	5	7—7½*	..	5 0 0
40,000	5	„	7½	Do. New	4	5—5½*	..	5 9 1
880,000	Stck.	14 Feb.	11½	Brentford Consolidated	100	229—234	..	5 0 5
125,000	„	„	8½	Do. New	100	167—172	..	5 1 9
220,000	20	14 Mar.	10½	Brighton & Hove, Original	20	43—45	+1	4 13 4
320,000	20	28 Mar.	11½	British	20	45—47	..	4 15 9
50,000	10	14 Mar.	11	Bromley, Ordinary 10 p. c.	10	20—22	..	5 0 0
39,000	10	„	8	Do. 7 p. c.	10	13½—14½	..	5 10 4
328,750	10	14 Nov.	10†	Buenos Ayres (New) Limited	10	16½—17½	+1½	5 11 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	107—110	..	5 9 1
150,000	20	28 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	11 Apr.	13½	Commercial, Old Stock	100	268—273	..	5 0 8
130,000	„	„	10½	Do. New do.	100	214—219	..	4 18 2
130,000	„	28 Dec.	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 3
557,320	20	13 Dec.	13	Continental Union, Limited	20	47—49	..	5 6 2
242,680	20	„	13	Do. New '69 & '72	14	33—34	..	5 6 7
200,000	20	„	10	Do. 7 p. c. Pref.	20	38—40	..	5 0 0
75,000	Stck.	28 Mar.	10	Crystal Palace District	100	204—208	..	4 16 2
234,050	10	30 Jan.	13	European, Limited	10	25½—26½	..	4 18 1
120,000	10	„	13	Do. New.	7½	17½—18½	..	5 5 3
854,060	10	„	13	Do. do.	5	12½—13½	..	4 16 3
5,468,600	Stck.	14 Feb.	13	Gaslight & Coke, A, Ordinary	100	254—258	−6	5 0 10
100,000	„	„	4	Do. B, 4 p. c. max.	100	100—105	..	3 16 3
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	257—262	−3	3 16 4
80,000	„	„	5	Do. F, 5 p. c. Prf.	100	123—128	..	3 18 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	182—187	..	4 0 2
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	166—171	−3	4 1 10
453,000	„	„	10	Do. J, 10 p. c. Prf.	100	256—261	−3	3 15 7
1,061,150	„	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	119—122	..	3 5 7
294,850	„	„	4½	Do. 4½ p. c. do.	100	125—130	..	3 9 3
650,000	„	„	6	Do. 6 p. c. do.	100	173—177	..	3 7 10
8,600,000	Stck.	15 May	10	Imperial Continental	100	203—207*	−7	4 16 6
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—115	..	4 6 11
541,920	20	29 Nov.	6	Monte Video, Limited	20	19—20	+½	6 0 0
150,000	5	29 Nov.	10	Oriental, Limited	5	9½—10	..	5 0 0
60,000	5	28 Mar.	7	Ottoman, Limited	5	6½—6¾	..	5 3 8
166,870	10	16 Jan.	4	Pará, Limited	10	5½—6	..	6 13 4
420,000	100	2 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	103—107	+2	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	98—102	+2½	5 17 8
100,000	10	26 Apr.	10	San Paulo, Limited	10	16—17	..	5 17 8
500,000	Stck.	28 Feb.	16½	South Metropolitan, A Stock	100	317—322	..	5 0 11
1,850,000	„	„	12½	Do. B do.	100	241—246	..	4 18 7
141,500	„	„	13½	Do. C do.	100	260—270	..	4 18 1
600,000	„	28 Dec.	5	Do. 5 p. c. Deb. Stk.	100	137—140	..	3 11 5
60,000	5	28 Feb.	11½	Tottenham & Edm'ntn, Orig.	5	11—13 *Ex div	..	4 8 5
				WATER COMPANIES.				
717,467	Stck.	28 Dec.	9	Chelsea, Ordinary	100	262—267	+2	3 7 5
1,720,560	Stck.	11 Apr.	7½	East London, Ordinary	100	204—208	..	3 13 1
700,000	50	13 Dec.	9	Grand Junction	50	122—126	..	3 11 5
708,000	Stck.	14 Feb.	10½	Kent	100	272—277	..	3 15 9
1,043,800	100	28 Dec.	9	Lambeth, 10 p. c. max.	100	250—255	..	3 10 7
406,300	100	„	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
200,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	118—120	..	3 6 8
500,000	100	14 Feb.	12½	New River, New Shares	100	348—353	..	3 8 8
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126—129	..	3 2 0
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	173—178	−1	3 7 5
126,500	100	„	6	Do. 7½ p. c. do.	100	162—167	..	3 11 10
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	264—269	..	3 14 4

† Next dividend will be at this rate

GARW WATER BILL.—This Bill came before a Committee of the House of Commons on Wednesday and Thursday last. Mr. Pope, Q.C., stated the objects of the Bill, which were to authorize the statutory incorporation of a limited Company, to empower the Company to construct works and supply water to one or two of the South Wales colliery valleys. He said that until 1884 there was no absolute water supply in the Garw Valley, which is in the neighbourhood of Bridgend. There was a numerous colliery population in the locality. In 1884 a systematic water supply became a matter not only of comfort, but of necessity; and a small limited Company was formed. It was now absolutely essential, in order that the Company might have the statutory responsibility as well as the statutory right of a water company, that they should apply for powers; and he thought there could be no possible objection to the proposal, provided it could be carried out without undue interference with the rights of other people. Evidence was then given as to the necessity for an improved water supply. Mr. Charles Hawksley, C.E., stated that the Company had 11,000 persons to provide for; and he mentioned that the estimate for the proposed works was £11,852, which included purchase of land and contingencies. There were only two petitions against the Bill. The Committee declared the preamble proved.

OLDHAM CORPORATION WATER SUPPLY.—At a recent meeting of the Oldham Corporation Water Committee, Mr. Herbert Andrews, the Water-Works Superintendent, submitted his annual report. It stated that the expenditure on capital account during the past year was: On the new works at Castleshaw, £51,121; on water-mains, £1540; water-meters, £476—making the total, £53,138. The gross revenue of the year amounted to £51,921; and the gross expenditure to £14,534 1s. 6d.—the balance carried to profit and loss account being £37,387, upon which sum the following charges fall:—Annuities and interest, £24,876; sinking fund for liquidation of debt on water-works, £8207; the surplus on the year's working being £4303. The income on revenue account was £51,921, against £51,715 in the previous year. The water-rental (including meter-hire) was £48,713, compared with £49,358 in the preceding year, or a decrease of £644. There was an increase of £205 from the water-rental for domestic purposes, &c., and a decrease of £849 from that for trade purposes, supplied per meter. The expenditure account was £14,534 against £14,143 in the preceding year. The sums payable for interest on mortgages, stock, &c., during the year amounted to £24,876, against £23,977; and the amounts paid to the sinking fund to £8207, against £6934 during the past year. The number of houses supplied with water is 42,607; being an increase of 579. There are 1152 water-meters in use, against 1027 last year.

PORTSMOUTH WATER COMPANY.—The half-yearly general meeting of this Company was held last Thursday—Lieut.-Col. E. Galt, J.P., in the chair. The Directors in their report stated that during the half year 4284 yards of new mains had been laid, and 464 additional house and other services put on; making the total premises served 32,223. The constant service system of supply had been well maintained. The number of houses now under the outside stopcock and district meter system is 22,339; leaving 9884 houses still to be fitted. The Directors are proceeding with this work by degrees, as the system is attended with great advantages. The water revenue for the half year was £21,038 10s.; making with the mill rents, &c., a total of £21,273 13s. 3d. The expenditure was £7523. The balance carried to the profit and loss account is £13,751 13s. 3d. The Directors recommended the full statutory dividends of 10 and 7 per cent. respectively on the several classes of shares, and that the balance of £2001 should be carried forward. The reserve fund is now £11,166 8s. 7d. The Chairman, in moving the adoption of the report, remarked that the use of the outside stopcock arrangement for the detection of waste of water at night had resulted in the saving of 500,000 gallons of water per diem without the necessity for a house-to-house inspection. Mr. G. Clarke seconded the motion. In answer to Alderman W. Kent, the Chairman said he was informed by the Resident Engineer (Mr. H. R. Smith, Assoc. M. Inst. C.E.) that the saving by the detection of waste amounted altogether to 1½ million gallons a day. The fixing of the stopcocks had cost £7000. The report was adopted. The retiring Directors (Mr. G. Clarke and Alderman J. Baker) and Auditor (Mr. W. Payne) were then re-elected; and the proceedings closed with a vote of thanks to the Chairman.

GWYNNE & CO., ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS & ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

Exhausters of nearly all sizes in Stock.

Prize Medals at all the Great International Exhibitions.

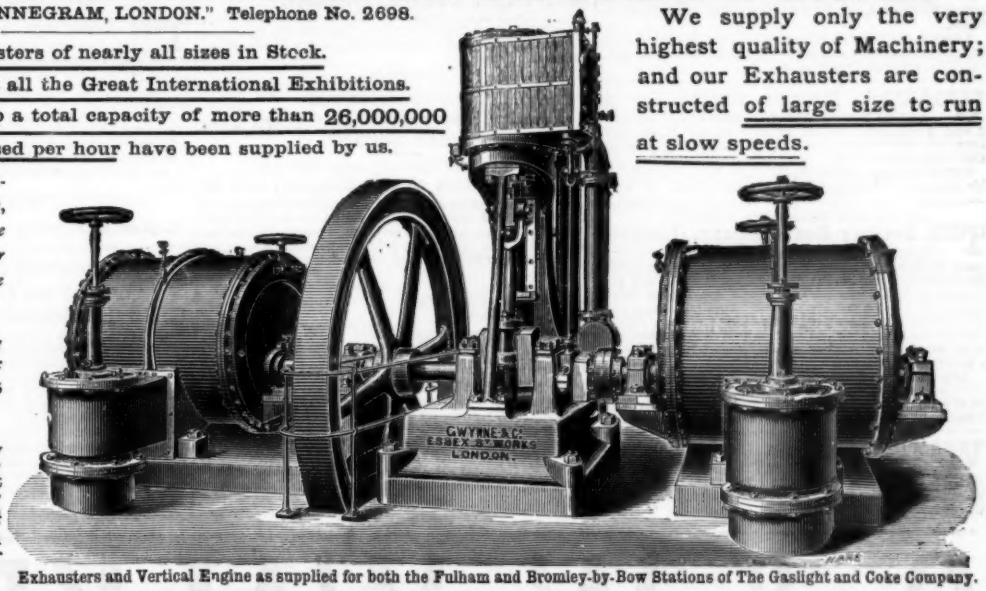
Exhausters equal to a total capacity of more than 26,000,000 cubic feet passed per hour have been supplied by us.

Our new Patent Non-Fluctuating Exhausters, to work without the slightest oscillation or variation in pressure, are strongly recommended.

MAKERS OF EVERY DESCRIPTION OF HYDRAULIC AND GAS MACHINERY.

Gwynne & Co.'s New Catalogue and List of Testimonials can now be obtained on application.

We supply only the very highest quality of Machinery; and our Exhausters are constructed of large size to run at slow speeds.



Exhausters and Vertical Engine as supplied for both the Fulham and Bromley-by-Bow Stations of The Gaslight and Coke Company.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

ANDREW STEPHENSON, Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Limited, Palmerston Buildings, Old Broad Street, LONDON, E.C.

CANNEL COAL, &c.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, / No. 54, BERNARD STREET, LEITH, } SCOTLAND.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt, Delivered in carboys or railway tank waggons.
For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street LONDON.

TIMMIS & CO., of STOURBRIDGE
Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats.
All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND CO, 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

ALEX. WRIGHT & Co., 55, 55a, and 56, MILLBANE STREET, LONDON, S.W.
[Telegraphic Address: "PRECISION LONDON."]
Makers of Wet and Dry Gas-Meters, Station Meters and Governors, Photometers, and Gas-Testing Apparatus, Test Gasholders and Meters, Registering and other Gauges, &c., &c.
*** See Advertisement on Page III. of the Wrapper of last week's issue.

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 1019 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

STEAM-JET PUMPS.

MELDRUM Bros., Engineers, of 26, Half Street, Cathedral Yard, Manchester, make and supply STEAM-JET ELEVATORS for Gas Liquor, Sulphuric Acid, Water, &c., specially proportioned for working conditions. Increase of temperature under 1° Fahr. per foot vertical for Water. Prices on application.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

TUBES.

FOR Gas, Steam, and Water; Galvanized, White Enamelled, and Hydraulic Tubes and Co.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour.
Highest References and all particulars supplied on application.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Tools, and Sundries.
*** See large Advertisement in last week's issue, page 986.

SHIPPING AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 9, Crosby Square, London, E.C., Shipping Agent to several Foreign Gas Companies, is prepared to attend to the Forwarding and Insurance of Goods for Foreign and Colonial Gas Companies, &c., and Gas Plant Manufacturers.

For Rates of Freight, apply as above.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice.

Address P. J. DAVIES, 78, Earl's Court Road, Kensington, LONDON.

STAPP'S Water-Gas Patents Company, Limited, is prepared to LEASE GAS-WORKS in the United Kingdom, or to supply PLANT, and adapt the same to existing Works to make a pure Gas to be supplied at a low price.

Address, with full details, SECRETARY, 120, CANNON STREET, E.C.

ADVERTISER, aged 22, seeks Engagement as GAS MANAGER or MANAGER and SECRETARY in Works making from 5 to 15 millions per Annum. Eight years' practical experience in Works making 20 millions. First-class references and testimonials.

Address, R. G., care of R. SHADBOLT, Gas-Works, Fleetwood, LANCASHIRE.

WANTED, by a young Man, age 30, a Situation as GAS-FITTER in Gas-Works. Is a good Main and Service Layer and Meter Fixer. Five years in last situation.

Address R. BRYANT, 38, Lyme Street, GREAT COLLEGE STREET, N.W.

WANTED, a competent Manager for small Gas-Works in Portugal.

Reply, stating qualifications, to R. W., 60, West Hill, SYDENHAM.

WANTED, in the Midland Counties, by a large Firm of Gas Constructing Manufacturing Engineers, one or two competent DRAUGHTSMEN.

Address, stating age, references, salary expected, and full particulars, G. A. S., care of Samuel Deacon and Co., 154, LEADENHALL STREET, E.C.

WORKING Manager wanted for a growing Town. Present annual make between 3 and 4 millions. Must be able to lay Mains and Services, fix Meters and do Retort Setting. House, Gas, and Coals found.

Apply, stating wages required, to No. 1711, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT MANAGER WANTED.

THE Bombay Gas Company, Limited, will require the services of a Gentleman to proceed to Bombay about August next as ASSISTANT MANAGER. Age about 24. Salary Rupees 300 per month, and Rupees 50 per month for House Rent. Terms of engagement Five years. Applicants must be practically acquainted with Gas Engineering, Manufacture, and Accounts, as well as be qualified to undertake any duties (indoor or outdoor) which may be allotted to him by the Manager.

Applications, by letter, stating age, and accompanied by copies of testimonials, to be addressed under cover to the Secretary of the Company, 6, Drapers' Gardens, London, E.C., and sent in on or before the 11th prox.

WANTED—Any Gas Company having for Sale one LIVESEY WASHER, and one KIRKHAM'S SCRUBBER for 500,000 feet per day, will please communicate with Mr. LONGWORTH, Gas Offices, GUILDFORD.

FOR SALE—Tar Stills, in sound condition. Distilling capacity, 8 to 18 tons. STEAM PUMP, 5-inch Ram, double-acting. ANTHRACENE FILTER PRESSES.

Address CULPAN AND SONS, Heckmondwike, YORKSHIRE.

FOR SALE—One Truck containing six Tanks, each 4 ft. 1 in. by 3 ft. by 2 ft. 7 in., fitted with Manhole, Cross-bar, and Screw. Plates, $\frac{5}{16}$ inch thick.

The Tanks are fitted with two Wrought-Iron Straps, Flanged at the Bottom, and have Outlet for 2-inch Pipes. They are in every way suitable for Tar Distillers.

The Truck and Tanks can be seen at Beswick Station, near Manchester.

Please address, with best offer, to the CLAYTON ANILINE COMPANY, LIMITED, Clayton, near MANCHESTER.

Gas Shares in well-known Companies, paying good Dividends and offering sound and highly desirable Investments.—By order of the Executors and Others,

MR. ALFRED RICHARDS will SELL by AUCTION, at the Angel Hotel, Edmonton (close to Silver Street Station, G.E.R.), on Monday, June 3, at Seven o'clock precisely in the Evening, in lots, GAS SHARES in the

Tottenham and Edmonton Gas Company, 103 Shares.
Lea Bridge Gas Company, 79 Shares.
Harrow Gas Company, 93 Shares.
Crystal Palace Gas Company, 40 Shares.
Barnet Gas and Water Company, 22 Shares and £108 Stock.
Ilford Gas Company, 10 Shares.
Gas Purification and Chemical Company, 8 Shares.
Ottoman Gas Company, 110 Shares.
Harwich Gas Company, 21 Shares.

Particulars may be obtained of the AUCTIONEER, TOTTENHAM, and 8, NEW BROAD STREET, E.C.

CITY OF MANCHESTER.

TENDERS FOR CAST-IRON PIPES.

THE Gas Committee are prepared to receive, on or before the 6th of June next, TENDERS for the supply of about 2000 tons of CAST-IRON PIPES, from 3 to 24 inches diameter.

Specifications and forms of tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order,
JOSEPH HERON, Town Clerk.

Town Hall, Manchester, May 24, 1889.

CAMBRIDGE UNIVERSITY AND TOWN GAS-LIGHT COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of this Company will, at their Meeting on June 20, be prepared to receive TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at these Works, for a period of One year, from July 1 next ensuing.

Further particulars may be had from the undersigned.

JAMES WEEKS, Manager.

Gas-Works, Cambridge,
May 23, 1889.

LONGWOOD GAS COMPANY, NEAR HUDDERSFIELD.

TENDERS for the surplus Tar and AMMONIACAL LIQUOR produced at the above Works for the ensuing Twelve months, commencing the 1st of July, 1889, are requested to be sent in to the undersigned.

Tenders, sealed and endorsed "Tender for Tar or Ammoniacal Liquor," to be sent in on or before Saturday, the 15th day of June, 1889. The Liquor to be 5° Strength, tested by a Standard Twaddel's Hydrometer.

NEILL MEIKLEJOHN,
Manager and Secretary.

BOROUGH OF MOSSLEY.

THE Gas Committee of the Mossley Corporation are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR that may be produced at their Gas-Works, Roaches, for Twelve months, from the 30th of June next.

Particulars and forms of tender may be obtained from the Manager, Mr. R. Merrell, at the Gas-Works.

Tenders, endorsed "Tar and Liquor," to be delivered to the Town Clerk not later than Noon on the 10th of June next.

The Committee do not bind themselves to accept the highest or any tender.

JOSEPH HYDE, Town Clerk.

TO COAL CONTRACTORS.

THE Sedgley Local Board invite Tenders for supplying from 500 to 1000 tons of GAS COAL; the deliveries to be made at the Shut End Siding, at such times and in such quantities as may be directed.

Sealed tenders, marked "Coal," to reach me on or before the 6th of June next.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSEPH SMITH, Clerk

High Holborn, Sedgley,
May 21, 1889.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for the surplus TAR and LIQUOR produced at their Works, for Twelve months from the 30th of June, 1889. Delivered free on Rails in Contractor's tanks.

Coal carbonized, about 2000 tons per Annum.

Sealed tenders, endorsed "Tar and Liquor," and addressed to the Directors, to be in by Monday, the 3rd of June, 1889.

CHARLES ELLIOTT,
Secretary and Manager.

Leyland, near Preston.

GAS COAL.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for their supply of CANNEL, COAL, NUTS, and SLACK, from the 30th of June, 1889, for One, Two, or Three years. Quantity used, about 2000 tons per Annum.

To be delivered free at Leyland Station in such quantities as required.

Monthly payments, less 1½ per cent.

Sealed tenders, endorsed "Gas Coal," and addressed to the Directors, to be in by Monday, the 3rd of June, 1889.

CHARLES ELLIOTT,
Secretary and Manager.

Leyland, near Preston.

CORPORATION OF WARRINGTON.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of 12,000 tons of GAS COAL or NUTS, and 4000 tons of CANNEL, for One, Two, or Three years, from the 1st of July next.

Forms of tender and further particulars may be obtained on application to Mr. W. S. Haddock, Engineer, Gas-Works, Warrington.

Tenders, endorsed "Tender for Coal" or "Cannel," must be addressed to the Chairman of the Gas Committee, and sent in not later than the 5th of June next.

The Gas Committee do not bind themselves to accept the lowest or any tender.

FREDK. TAYLOR, Secretary.

Gas Office, Warrington, May 10, 1889.

C. & W. WALKER.

GASHOLDERS; PURIFIERS; PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT;

RETORT MOUTHPIECES; CONDENSERS;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SLIDE VALVES; TAR BURNERS; &C., &C.,

WOOD SIEVES.

ADDRESSES:

8, Finsbury Circus, London, E.C.; Midland Works, Donnington, Salop.

"FORTRESS LONDON," "FORTRESS DONNINGTON,"—Telegraphic.

THE Isle of Thanet Gas Company invite TENDERS, to be delivered on or before Tuesday, June 18, 1889, for the supply of 2800 tons of the best Seaborne GAS COAL.

Particulars and times of delivery may be had on application to

THOMAS C. FULLER, Secretary.

Gas-Works, Margate,
May 24, 1889.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the supply of about 14,000 tons of screened or unscreened GAS COAL, and about 3000 tons of CANNEL, to be delivered at their Works in Carlisle in such quantities as may be directed, from July, 1889, to June, 1890.

Tenders, specifying the description of the Coal or Cannel, the pits at which they are raised, and the terms for net monthly payment, are to be sent on or before July 3, 1889, endorsed "Tender for Coal."

J. HEPWORTH,
Engineer and Manager.

Gas-Works, Carlisle,
May 22, 1889.

CITY OF CARLISLE.

TAR CONTRACT.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the surplus TAR to be produced at their Works, for a period of One or more years, from the 30th of June next.

Any further particulars required can be obtained upon application to the Engineer, to whom sealed tenders, endorsed "Tender for Tar," must be delivered on or before June 5, 1889.

The Committee do not bind themselves to accept the highest or any tender.

J. HEPWORTH, Engineer.

Gas-Works, Carlisle,
May 22, 1889.

SALFORD CORPORATION GAS-WORKS.

COAL AND CANNEL.

TO COLLIERY PROPRIETORS.

THE Corporation of Salford invite Ten- ders for the supply of the COAL and CANNEL required at their various Gas Stations in Salford, for One, Two, or Three years.

Forms of tender, and conditions upon which only tenders will be received, may be obtained on application at my Office, Town Hall, Salford.

Tenders, endorsed, "Coal and Cannel Contract," addressed to the Chairman of the Gas Committee, to be delivered to me before Five p.m. on Thursday, the 30th inst.

By order,
SAMUEL BROWN, Town Clerk.

Town Hall, Salford, May 17, 1889.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

TENDERS FOR IRONWORK.

THE Gas Committee invite Tenders for the COLUMNS, GIRDERS, FLOOR-PLATES, BUCKSTAVES, RETORT MOUTH-PIECES, HYDRAULIC MAINS, and other IRON-WORK required for the Liverpool Street Gas-Works.

The drawings and specifications may be seen on application to the Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Ironwork," to be delivered at my Office not later than Five p.m., on Thursday, the 13th of June, 1889.

By order,
SAM. BROWN, Town Clerk.

Town Hall, Salford,
May 25, 1889.

RAMSGATE CORPORATION.

GAS AND WATER DEPARTMENT.

THE Gas and Water Committee invite TENDERS for the supply of first-class NEWCASTLE GAS COAL in three Annual quantities of 12,000 tons each, delivered free into carts on the Quay of Ramsgate Harbour. The first 12,000 tons to be delivered in equal monthly quantities, between the 1st of September, 1889, and the 31st of August, 1890; and the second and third years' supply in equal monthly quantities, between the 1st of September, 1890, and the 31st of August, 1891, and the 1st of September, 1891, and the 31st of August, 1892. Separate prices to be named for each annual quantity.

Tenders to be sent in not later than Tuesday, June 11, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, and endorsed "Coals."

The Committee do not bind themselves to accept the lowest or any tender.

Full particulars and form of tender on application to

WILLIAM A. VALON, Engineer.

WESTGATE AND BIRCHINGTON GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of first-class NEWCASTLE GAS COAL in three Annual quantities of 1500 tons each, to be delivered free in Trucks, at the Westgate Railway Station, L. C. & D. Line. The first 1500 tons to be delivered in equal monthly quantities, between the 1st of September, 1889, and the 31st of August, 1890; and the second and third years' supply in equal monthly quantities, between the 1st of September, 1890, and the 31st of August, 1891 and the 1st of September, 1891, and the 31st of August, 1892. Separate prices to be named for each annual quantity.

Tenders to be sent in not later than Tuesday, June 18, addressed to the Chairman of the Westgate and Birchington Gas Company 3, Princes Street, Storey's Gate, Westminster, S.W., and endorsed "Coals."

The Directors do not bind themselves to accept the lowest or any tender.

Full particulars and form of tender on application to

WILLIAM A. VALON, Engineer.

WARWICK GASLIGHT COMPANY.

TO TAR DISTILLERS.

THE Committee of the Warwick Gas light Company are desirous of receiving TENDERS for the purchase of their surplus TAR, for One or Three years, commencing July 1 next.

Tenders to be sent to the undersigned not later than June 11, 1889.

WALTER T. TEW, Manager.

Gas-Works, Warwick, May 8, 1889.

CORPORATION OF BURNLEY.

OXIDE OF IRON.

THE Gas Committee of the Burnley Cor- poration are prepared o receive TENDERS for the supply of 150 tons of OXIDE OF IRON for Purification. The Oxide must be delivered at Burnley either by Rail or Canal. Parties tendering will be required to furnish samples of the Oxide proposed to be supplied.

Tenders, endorsed "Tender for Oxide," and addressed to the Chairman of the Gas Committee, must be delivered at the Town Hall, Burnley, on or before the 29th of May, 1889.

WALTER SOUTHERN, Town Clerk.

Burnley, May 17, 1889.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Accrington Gas and Water Works Company invite TENDERS for the TAR and AMMONIACAL LIQUOR to be produced at their Accrington and Great Harwood Works for One year, commencing on the 1st of July next. Coal carbonized at Accrington, 12,000 tons; and at Great Harwood, 8000 tons.

Any additional information can be obtained on application to the undersigned.

Tenders, endorsed "Tender for Tar and Liquor," to be sent in not later than Wednesday, the 12th of June, addressed "The Chairman, Gas-Works, Accrington."

CHARLES HARRISON, Secretary.

Offices of the Company,
May 18, 1889.

THE PETERBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of best screened GAS COAL and NUTS, for One or Two years, commencing the 1st of July next.

Form of tender and conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 10th of June, 1889, endorsed "Coal," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, New Road,
Peterborough, May 17, 1889.

THE PETERBOROUGH GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the above Company invite TENDERS for the purchase of the surplus TAR produced at their Works, for One year, commencing the 1st of July next.

Form of tender and conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 10th of June, 1889, endorsed "Tar," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the highest or any tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, New Road,
Peterborough, May 17, 1889.

TENDERS FOR GAS COAL.

THE Directors of the Clayton, Allerton, and Thornton Gas Company invite TENDERS for the supply of 5000 tons of GAS COAL and NUTS COAL, also 600 tons of CANNEL, per year. The Coal to be Screened, free from Scale, Sulphurous Pyrites, or other objectionable matter, and to be delivered at the Gas-Works, Low Lane, Clayton, or at the Great Northern Railway Station, Clayton, in such quantities weekly as may be ordered by the Company's Manager, during One, Two, or Three years, as may be agreed upon. The said tenders to state the Seam and the Pit from which the Coal is intended to be sent.

Sealed tenders, endorsed "Tenders for Gas Coal," addressed to the Chairman, at the Gas-Works, to be delivered at or before Noon on Monday, the 3rd day of June, 1889.

The Directors do not pledge themselves to accept the lowest or any tender, reserving to themselves the right to divide the contracts as they may think proper.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas Offices, Clayton,
near Bradford, May 14, 1889.

TO COLLIERY PROPRIETORS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for 130,000 tons of screened GAS COAL and 26,000 tons of CANNEL (not Scotch), to be delivered during Twelve months, from July 1, 1889, to June 30, 1890, as follows:—106,000 tons to be delivered at the Company's Siding at Neepsend, on the M. S. & L. Railway, and 50,000 tons to be delivered by Carts at the Effingham Street or Neepsend Works in such monthly quantities as may be required.

Tenders to state the maximum quantity the Contractors can supply.

The Directors reserve the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

Conditions and forms of tender may be obtained on application to the undersigned.

Tenders, marked "Tender for Coal," must be delivered at the Company's Offices not later than Monday, June 3, 1889.

HANBURY THOMAS,
General Manager.

Gas Company's Offices, Commercial Street,
Sheffield, May 15, 1889.

CORPORATION OF LANCASTER.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of about 7000 tons of GAS COAL per Annum, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One, Two, or Three years, commencing delivery in July next.

Sealed Tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be sent to Thorn Swainson, Esq., Town Clerk, Lancaster, on or before the 17th day of June next.

Forms of tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

C. ARMITAGE

Gas-Works, Lancaster,
May 21, 1889.

ST. HELENS CORPORATION.

(GAS DEPARTMENT.)

TO TAR DISTILLERS.

THE Gas Committee of the Borough of St. Helens are prepared to receive OFFERS for the purchase of the surplus TAR produced at their Works for a period of One year, from the 1st of July, 1889, to the 30th of June, 1890.

Offers to be at per ton of 20 cwt., delivered into Contractor's tank-wagons at the Gas-Works Siding, St. Helens.

Quantity, about 1000 tons, more or less.

Forms of tender and all information may be obtained upon application to the undersigned.

Tenders, properly endorsed, to be delivered to the Chairman of the Gas Committee, Gas-Works, St. Helens, on or before Tuesday, the 11th of June next.

The highest or any other tender not necessarily accepted.

SAMUEL GLOVER, Manager.

Gas-Works, St. Helens, May 15, 1889.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Brighouse Local Board are pre- pared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works for a term of One, Two, or Three years, from the 1st of July next.

The quantity of Tar made is about 350 tons per Annum.

The Tar can be loaded into Contractor's Carts on the Works, or into Barges on the Aire and Calder Canal (which runs alongside) by pipe direct from the Works. Any further particulars can be obtained on application to the undersigned.

Sealed tenders, endorsed on the outside "Tender for Tar," stating price per ton at the Gas-Works, must be sent in on or before Tuesday, the 4th day of June, 1889, addressed to Richard Kershaw, Esq., Chairman of the Local Board, Public Offices, Brighouse.

The Board do not bind themselves to accept the highest or any tender.

By order,
JAMES PARKINSON, Manager.

Brighouse, May 17, 1889.

THE SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the Twelve months commencing July 1, 1889.

The estimated quantity for disposal is about 750 tons per Annum.

Forms of tender, containing all further particulars, may be obtained on application at the Company's Works, or by post.

Tenders to be sent in to the undersigned not later than the 15th day of June, 1889.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc. M. Inst. C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 16, 1889.

THE SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas- light Company invite TENDERS for the supply of best screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Twelve months commencing July 1, 1889.

About 10,000 tons per Annum will be required under the contract.

The Directors reserve to themselves the right to divide the quantity into two or more contracts, and do not bind themselves to accept the lowest or any tender.

Forms of tender, containing all further particulars, may be obtained on application at the Company's Works, or by post.

Tenders to be sent to the undersigned on or before the 15th day of June, 1889.

By order,
WM. BELTON, Assoc. M. Inst. C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 16, 1889.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is hereby given that the Seven- TEENTH ORDINARY GENERAL MEETING of the Company will be held at Winchester House, Old Broad Street, London, on Friday, the 31st day of May, at Twelve o'clock, Noon, when the Directors will present a Report and an Audited Statement of Accounts for the Year ended the 31st of December, 1888.

The Books for the transfer of Shares will be closed from Monday, the 20th, to Friday, the 31st of May, 1889, both days inclusive.

Dated this 20th day of May, 1889.

By order,
THOMAS F. LANE, Secretary.

Offices of the Company,
103, Gresham House, Old Broad Street,
London, E.C.

JUST PUBLISHED.

EDITED BY CHARLES W. HASTINGS.

The Gas & Water Companies' Directory, 1889.
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FOR GAS, WATER, AND STEAM.

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CONTRACTING GAS ENGINEERS,

Manufacturers of GAS-WORKS APPARATUS of every description.

Livesey & Tanner's Patent TAR AND LIQUOR OVERFLOWS and TAR SCREEN for Hydraulic Mains.

TESTIMONIAL.

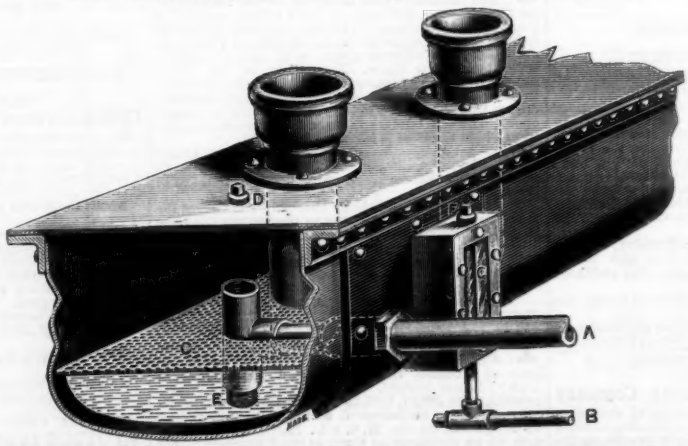
Croydon Commercial Gas and Coke Company.
May 29, 1888.

MESSRS. S. CUTLER & SONS,

GENTLEMEN,—In answer to your letter of the 26th inst., I am pleased to be able to say that I am so satisfied with the LIVESEY AND TANNER TAR OVERFLOWS which I have had in use during the past winter, that I have recommended their adoption throughout our retort-houses

I am, yours faithfully,

J. W. HELPS.



TESTIMONIAL.

Gas-Works, Tunbridge Wells,
Feb. 15, 1889.

MESSRS. S. CUTLER & SONS,

GENTLEMEN,—In reply to your inquiry respecting LIVESEY AND TANNER'S TAR AND LIQUOR OVERFLOWS, I have much pleasure in saying that they continue to give every satisfaction.

A few months ago I had a very striking proof of their value. I started four beds without the "Overflows," allowing the Tar to travel along with the Gas, when the illuminating power dropped a candle, and did not regain the loss until the "Overflows" had been put into operation. This experiment was repeated with the same result.

The apparatus requires but little attention; and if a small quantity of tar is run off regularly every morning, nothing further is required.—Yours faithfully,

ANDREW DOUGALL, Jun.,
ASSOC. M. Inst. C.E.

Index to Reference Letters in Illustration.

A, Tar-Pipe. B, Liquor-Pipe. C, Perforated Tar Screen, to prevent oscillation of liquor. D, Plug in top plate for access to nipple by special key. E, Nipple to adjust to within, say, ½ inch from bottom of main. F, Plug for access to nipple to adjust liquor level and for cleaning glass. G, Glass to see levels of tar and liquor in main.

MORRIS AND CUTLER'S PATENT "PERFECT" CONDENSER.
CUTLER'S PATENT SCRUBBER DISTRIBUTORS.
CUTLER'S PATENT WATER-VALVES FOR PURIFIERS.

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Illuminating Power . . 29·21 candles.
Coke per ton . . . . 1266·96 lbs.

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Yield of Gas per ton . . 10,784 cub. ft.
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Illuminating Power . . . . . 39·22 candles
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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.
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One ton yields 12¼ cwt. of good coke.
This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.
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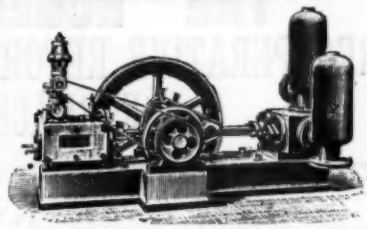
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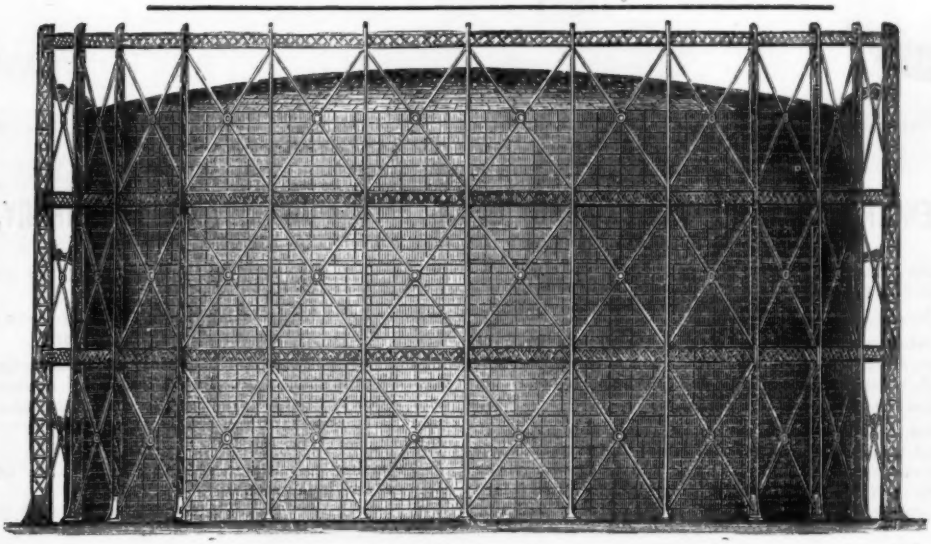

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PURIFIERS with PLANED JOINTS; CENTRE-VALVES TO WORK ALL FOUR PURIFIERS; EXHAUSTERS,

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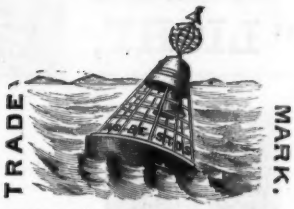


CONSISTENCY OF ASBESTOLINE.

ASBESTOLINE, to meet all circumstances, is made in four degrees of consistency—A, B, C, and CC.

ASBESTOLINE, A, is specially adapted to ordinary Land Engines and Machinery, in and out door, in this country.

ASBESTOLINE, B, a little more solid, is for use on Steamships in temperate climates, also on land when it is desirable to have Lubricant stiffer than A.

ASBESTOLINE, C, is for use in tropical climates, both ashore and afloat. It is also invaluable in works in this country when the temperature is high.

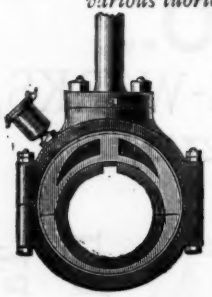
ASBESTOLINE, CC, is designed for use on Calenders, Paper-Machines, &c., where the bearings are heated by steam passing through, and sometimes is advantageously used instead of C.

The reputation of Asbestoline as a Lubricant of the highest efficiency in every kind of Machinery is established; and it has never been equalled by any other Lubricant in the numerous cases of special difficulty in which the best oils are ineffectual. It is used with marked success in Steel and Iron Works, Collieries, Cotton and Wool Mills, and other Textile Manufactories. In Corn-Mills it has proved invaluable on the roller and other modern machines. In Saw-Mills, on machines going up to 5000 revolutions per minute, its work has never been approached by any other Lubricant. On Electric Lighting Machinery, and in Steamships of all sizes throughout the world, the success of Asbestoline is unequalled. Many engines and machines of all descriptions give trouble, and show bad results both in working and wear, when the system of lubrication has not received due consideration. Engineering firms of the highest standing have given to it their powerful testimony and support.

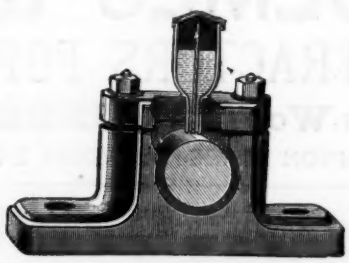
Supplied in Kegs, 28, 56, or 112 lb. Price, 2/3 per lb. Kegs Free. Special Terms for Large Quantities.

IMPORTANT TO EXPORT MERCHANTS.—*One pound of "Asbestoline" equals 2 gallons of Oil weighing 18lbs.; consequently the saving in freight is very considerable. Liberal Terms are conceded to Export Merchants.*

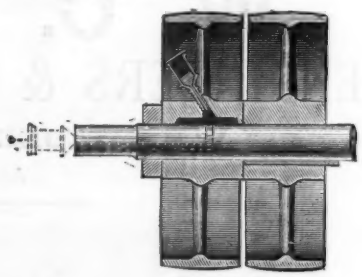
Below will be found illustrations of the mode of fixing Lubricators for Asbestoline to bearings. Full particulars of the various lubricators supplied for Asbestoline, and the manner of fitting, in catalogue free on application.



Lubricator fitted to Eccentric of Vertical Engine.



Showing Section of Lubricator fitted to ordinary Bearings.



Lubricator in different position for Loose Pulleys.

THE ATTENTION OF

ENGINEERS, AND ALL USERS OF STEAM POWER AND MACHINERY,

IS SPECIALLY INVITED TO THE FOLLOWING REPORT.

Owing to the number of Greases now offered, samples of BELL'S ASBESTOLINE were submitted to Otto Hehner, Esq., for analysis, and the subjoined Report fully proves BELL'S ASBESTOLINE to be the safest as well as the best Lubricant for all purposes :—

The Laboratory, 11, *Billiter Square, E.C., London, May* 3, 1888.

I have subjected a sample of Bell's Asbestoline taken from the stores of Messrs. J. Bell and Son, in Southwark Street, to a number of tests, in order to ascertain whether its use in Mills or Factories might contribute to the danger from Fire.

I found that Asbestoline **ignites only with the greatest difficulty** when brought into contact with flame; that wood and other combustible material soaked in Asbestoline burns, if anything, with greater difficulty than by itself; that its **flashing point is so high that it lies beyond the range of Mercurial Thermometers**; and that consequently no friction obtainable in the ordinary run of machinery is capable of developing inflammable vapours from it.

Bell's Asbestoline is **as absolutely safe a Lubricant as can be desired or obtainable.** In the case of fire breaking out from any cause, it does not assist the conflagration; and it is **quite incapable of leading to spontaneous combustion,** either by itself or in contact with inflammable material.

From the physical nature of Asbestoline its use is of necessity perfectly clean and free from waste.

(Signed) OTTO HEHNER, Public Analyst.

Illustrated Priced Catalogue, with numerous Testimonials by Leading Firms, free on application.

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DEPOTS—MANCHESTER: Victoria Buildings, Deansgate. LIVERPOOL: 2, Strand Street, James Street.

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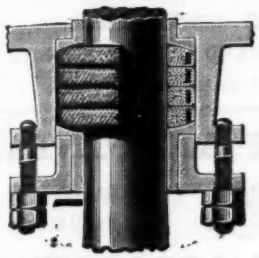
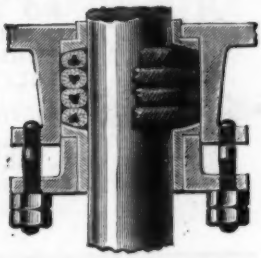
PATENT No. 15,498.



ROUND. SQUARE.



Every 10 feet has Label as above, and bears our Trade Mark.

Under this registered title are included the inventions of Mr. Field; and experience has proved them to be the MOST EFFICIENT, DURABLE, and ECONOMICAL PACKINGS ever made. They constitute such a combination of Asbestos and India-rubber as secures the maximum of elasticity and heat resistance; and they are, therefore, UNEQUALLED FOR EVERY KIND OF ENGINE. These Packings are being universally used by most of the leading Steamship Companies throughout the world for ordinary Compound, Triple, and Quadruple Expansion Engines of the latest type. The packings are composed of rolled Asbestos Cloth, but the India-rubber is placed in two forms to suit various cases.

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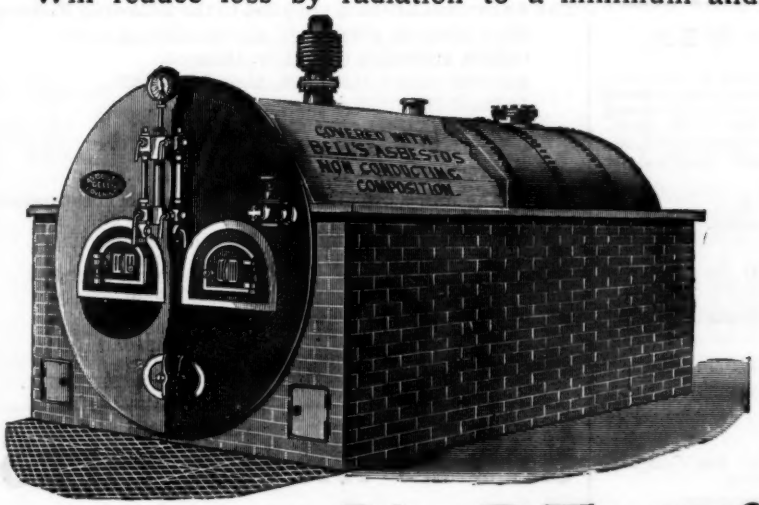

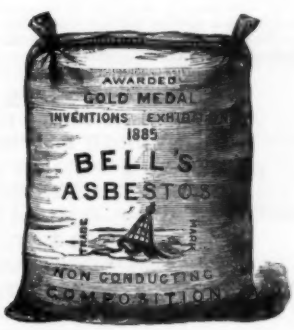

Price 25s. per Cwt.

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It is essential in covering that it shall not only be a non-conductor, but a substance free from whatever can injure metal, and of a nature which will enable it to adhere well for years. To do this it must be sufficiently elastic to prevent cracking and leaving, by expansion and contraction, the heated surfaces to which it is applied. This Composition is daily applied to Tanks **with Round or Flat Bottoms**, and its adhesive properties enable it to keep to the surfaces without bands or any device necessary for holding on other compositions. Our covering never fails to **Save its Cost in a few months, lasts for years,** after which it can be taken off and applied again with a little fresh. In all respects it is so superior as to be infinitely cheaper than Compositions sold at one-fourth the price. We would point out that this, being supplied **dry in bag,** will cover **six times** more surface than other materials which are sent out wet in cask. This shows the apparent low prices of other Compositions to be a sham.

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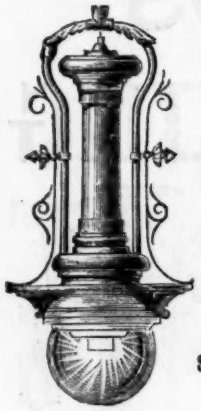

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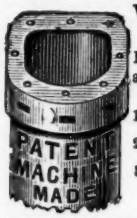

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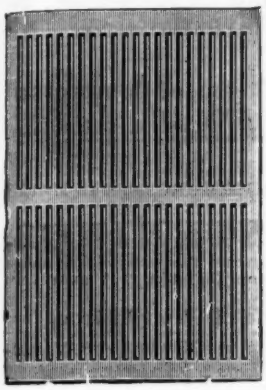

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